455 - FOR.215

CATALOG T9

TROMPETER ELECTRONICS, INC.

PATCHING SWITCHING SYSTEMS

455/3.1

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INTRODUCTION

The equipment and components displayed in this catalog are based on a need to provide standard system interface patching and switching so that the many end equipments available from other manufacturers could be interconnected with a minimum of engineering, space, and costs. The available items consist of coax Patch Panels, Patch Cords, Jacks, Looping Plugs, Power Dividers, RF Connectors, Switches, Matrices and Systems manufactured to the highest standards of government and industry. Consideration is also given to the avoidance of unwanted noise and interference via equipment interconnecting cables, with provision to isolate signal return lines from ground. This is accomplished by using twinax, triax, or quadrax components for system shielding, and common mode isolation and rejection.

APPLICATIONS

Computers - TV Broadcast - CATV - CCTV - ETV - Communications - Telephone - Missile and Space Telemetry - Aircraft - Nuclear and Industrial Instrumentation - Process Controls - Security Equipment - Automatic Testing - Information Retrieval - Microwave Data Transmission.

FEDERAL STOCK NUMBERS

Federal Stock and Air Force GEEIA Catalog numbers have been assigned to most Trompeter parts. Each list is available upon request.

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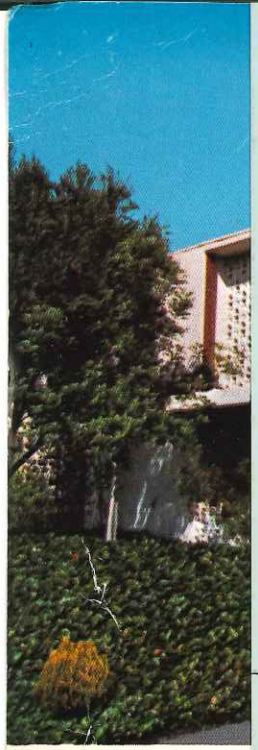
	Page
	1-8
	9-10
	11-13
	14
	15
	16
	17-19
	20
	21
	22
	23
	24
	25-26
	27-29
	30
	31
	32
	33
	34
	34
	35
	36
	37
	37
	38
	39-40
	41-42

SWITCHING

Introduction and Applications	43-44
Matrices and Switch Description	45
Definitions and Terms	46
General Operation and Construction	47
Electrical Specifications and Characteristics	48
Part Numbers and Ordering Information	49
Typical Matrices and Switching Models	50
High Frequency to 3 GHz Specifications	51-52
High Frequency Switches/Matrices Ordering Information	53
Microwave I.F. Switching (70 MHz 75 Ohm)	54
Low Frequency Systems (DC)	55-56
Systems and Control	57-58
Typical Systems	59-60



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Compute
- Communications - Telephone - Missile and Space Telemetry - Aircraft - Nuclear and Industrial Instrumentation - Process Controls - Security Equipment - Automatic Testing - Information Retrieval - Microwave Data Transmission.

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INDEX

	Page
Electronic Systems Wiring and Cabling	1-8

PATCHING

STANDARD

Standard Patch Panels	9-10
Standard Panel Jacks (Coaxial)	11-13
Patch Cords and Plugs (Coaxial)	14
Parallel Patch Cords and Plugs (Coaxial)	15
BNC Parallel Networks	16
Coaxial Connectors — Unicut Design; Type BNC and TNC Plugs. Insulated and non-insulated receptacles. Assembly instructions	17-19
Type "N" and "C" Plugs and Receptacles	20
Type "N" and "C" Adapters and Terminations	21
Coaxial Connectors — Semi-Rigid Cable	22

MINIATURE

Miniature Patch Panels	23
Miniature Patch Plugs and Jacks (Coaxial)	24
Miniature Patch Cords and Networks (Coaxial)	25-26
Miniature Coaxial Connectors—Unicut Design SMA, Miniature Bayonet, TPS	27-29
Western Electric Type Miniature 75 Ohm Panels, Jacks and Plugs (Coaxial)	30

TWINAX, TRIAX AND QUADRAX CONCENTRIC DESIGN

Twinax/Triax Concentric Jacks and Plugs	31
Twinax/Triax Concentric Patch Cords	32
Twinax/Triax Concentric Plugs and Receptacles	33
"C" Type Concentric Twinax/Triax Connectors	34
Quadrax Connectors	34
Twinax/Triax/Quadrax Cable Groups	35
Improved Video and High Frequency Cables	36
Precision Patching 50 Ohm (Coaxial)	37
Precision Patching 75 Ohm (Coaxial)	37
Teflon Jacketed Cable Connectors (Coax, Twinax, Triax)	38
Custom Components — Special Connectors, Networks, Adapters and Accessories	39-40
Typical Patching Systems	41-42

RECEIVED AUG 27 1973 GROUP 230

SWITCHING

Introduction and Applications	43-44
Matrices and Switch Description	45
Definitions and Terms	46
General Operation and Construction	47
Electrical Specifications and Characteristics	48
Part Numbers and Ordering Information	49
Typical Matrices and Switching Models	50
High Frequency to 3 GHz Specifications	51-52
High Frequency Switches/Matrices Ordering Information	53
Microwave I.F. Switching (70 MHz 75 Ohm)	54
Low Frequency Systems (DC)	55-56
Systems and Control	57-58
Typical Systems	59-60

ELECTRONIC SYSTEMS WIRING AND CABLING

After buying the most expensive "end" equipments, many systems engineers have difficulty in determining the best methods of cabling, interconnection and routing of signals from place to place, with the minimum of loss, degradation and noise pickup. Often, simple solutions such as selecting the correct cable, eliminating common mode grounds or space separating long runs of parallel cables will make the difference between a good or bad system. It must be emphasized that these and other good practices must be implemented at the time of initial design and are almost impossible to install after the system is built. This "interface" engineering will be discussed in two subsequent sections (1) Signal Degradation; (2) Noise.

As an introduction, the systems engineer should study his systems parameters and noise environment before selecting his interface components. Consideration must be given to (a) signal frequencies, whether audio, video, I.F. or R.F. (b) voltage and power levels (c) tolerable losses or degradation, including the possibility of reflected signals due to discontinuities (d) pickup of noise from direct contact common mode and ground loop returns, or radiated stray magnetic and capacitive fields.

Due to the susceptibility of circuit wiring and cabling to the pickup of noise, all **low** voltage level wiring should be shielded irrespective of frequency to be transmitted. Coax cable, although primarily designed to carry R.F., is excellent to use as low frequency shielded wire since it is relatively inexpensive (RG-58, RG-122, etc.) and many complete series of coax connectors are readily available.

For higher frequencies, coax cable **must** be used for point to point wiring since it has the transmission characteristics, flexibility and economy necessary for most systems. At this point it might be enlightening to some readers to explain the various impedance standards of 50, 75 and 93Ω coax cables. The most efficient impedance to use when transmitting any signal considering the voltages, currents and powers to be transmitted is 75Ω, and would be the only standard if these were the sole considerations. The telephone industry, followed by the TV industry, use 75Ω almost exclusively for the transmission of video, baseband and I.F. frequencies. The military services during the period 1920 thru 1940, were faced with a differing need for low radiation angle omnidirectional antennas for broadcasting ship to ship, airport tower to low flying aircraft and base station to ground troops. The only antenna that would give this performance was the **vertical ground plane** in its many forms, which turned out to be 50Ω. The military standardized on 50Ω impedance and spent vast sums of money developing cables and connectors for all of their coax systems. At one time a military agency, Armed Services Electro Standards Agency (ASESA), designed all military coax components and assigned the connector UG and cable RG designations. This has since been replaced with the latest government/industry committees cooperating and producing the current general connector standard MIL-C-39012 primarily for 50Ω usage. 93Ω cable came about due to the need for low capacitance instrumentation coax cable. By simply removing **some** of the coax dielectric and substituting air in RG-59, the distributed capacitance was lowered, thereby creating a lower loss **voltage** transmission medium RG-62.

More sophisticated cables and connectors of twinax, triax and quadrax are now available to improve external noise rejection, or to contain classified signals and keep them from becoming a security compromise as will be described later.

To successfully complete any signal transmission system, the engineer must move the various signals from place to place with (1) minimum signal degradation and loss, (2) reduce unwanted external noise to an acceptable level, or a mix of 1 and 2. The discussion that follows applies generally to all frequencies of data, video, I.F. and R.F.; however, each case must be studied and considered by itself with the proper remedies applied.

1. Signal Degradation

Signal degradation in any transmission medium usually consists of voltage amplitude reductions, wave shape changes, phase or delay changes, or power losses where power is transmitted. Since the interconnecting cable is the longest transmission path in most systems, its selection, manufacture, testing and installation should be carefully considered and not randomly selected and installed as is the usual practice. When selecting cable from specifications, always consider the length of the cable run, heat exposure, frequency and power to be transmitted vs. the acceptable losses inherent in the cable, the external noise fields and frequencies to be anticipated or encountered, and the easy availability of connectors to terminate the cable. Too small a cable will always be cause for excessive losses. Fast rise time digital pulses will have the leading edge distorted due to the high resistance "skin" effect of small coax cables. When selecting a cable for a long run, observe the insertion loss to insure that your signal gets to its destination without too much loss. When in doubt choose a bigger cable! Incomplete copper coverage in the outer braid over the dielectric will also cause transmission line losses as well as cable susceptibility to signal leakage or noise pickup. Unseen manufacturing faults produce signal path impedance changes or discontinuities which can only be detected by "frequency sweeping" the cable. TV broadcasters have encountered as high as 60 dB losses in short runs due to periodicity and other manufacturing faults detectable only by swept frequency testing techniques. Many cable defects are not readily visible and may not show up without proper testing. In buying coax cable, the reputation of the manufacturer, type, quantity and quality of material used is more important than the few pennies saved buying the cheapest unknown brand. In system design, be careful that the cable does not support equipment or is subject to prolonged exposure to heat. Do not tightly "bundle" cables so as to cause crosstalk, and do not bend beyond the manufacturers recommended radius of bend which would produce cable discontinuities. When routing cables try to space separate high signal level or power circuits from low victim cables.

Signal cables are usually manufactured using polyethylene which is adequate for normal use. Where high heat or chemical action will attack poly cables, teflon (DuPont) dielectric and sheathed cables should be used, such as in aircraft or industrial plants. The National Fire Underwriters now requires non-fire supporting cable to be used for all open wiring in public buildings. Fire insurance rates could be greatly reduced in computer, nuclear accelerator and other large installations if TFE or FEP cables were used.

Coax Cable Connectors — Any connector must be able to interconnect with very low d.c. series resistance, something less than 10 milliohms. The impedance of a connector is usually of no consequence below approximately 300 MHz since the connector does not contribute to circuit performance until its length approaches 1/20th of a wavelength. For this reason, 50Ω connectors can be attached to 75Ω **video** cables with no detrimental effect. Above 300 MHz, coax connectors should be impedance matched to the system impedance.

There are many types and series of coax connectors presently available, and the multiplicity is probably very confusing to most users. Many of the lesser known series were designed for specific problem solutions or were developed by commercial companies for their own proprietary product line. Through the years, the connector series listed below have gained universal acceptance due to their simplicity and outstanding performance. They are produced and stocked by a majority of coax connector manufacturers.

Nominal Cable Size O.D.	Connector Size	Quick Disconnect	Threaded
.3 to .425"	Medium	C	N
.10 to .3"	Miniature	BNC	TNC
.10 to .242"	Sub-Miniature	TPS	SMA

Much can be written to discuss the advantages of one series of connectors over another and usually the choice is either economic or performance depending upon the required system parameters. This discussion is outside the intended purpose of this paper; however, a mention should be made of the cable to connector attachment philosophy-crimping or soldering.

Crimping is usually used where speed of attachment is important or where it is virtually impossible to solder due to lack of available soldering iron power as on the top of a telephone pole or in a cable vault. Crimping requires an expensive crimp tool that can be improperly used or out of adjustment to give a poor connection. Additionally, crimped contacts over a period of time usually corrode, making for a bad contact particularly in chemical or salt atmosphere (Reference No. 7). Soldering on the other hand does not require any expensive tools not normally found in any tool box. The soldered connection will not corrode provided adequate heat is applied and correctly done to avoid a "cold" solder joint. One of the advantages of the solder approach is that many coax connectors are now made to be used over and over again with no special tools and no replacement parts required. This is particularly advantageous in shipboard or field locations where spare parts or special tools are not always available.

2. Noise

Electrical noise has the accepted definition of being any unwanted and interfering voltage developed within, or external to a system, which reduces the performance of that system. Interfering noise has always been a problem and in the past was usually reduced by brute force filtering, which worked on the principal of stopping the noise **after** it had entered the system. This method was quite expensive, but reasonably effective since signal information voltages were low in frequency while systems were few and not too large or complex.

Present day communication and data systems are continually becoming larger and more numerous, using higher information rates and frequencies, in an atmosphere of expanded electrical and electronic equipment usage. The net result is ever increasing interference and noise creating an electronic traffic jam of major proportions. This applies equally true whether low level analog or digital pulse systems are used. Filtering is practically useless or, in some cases, completely unusuable since it produces excessive deterioration of the desired pulse waveforms, or inaccuracies and distortion of analog signal voltages. Obviously, noise reduction is best accomplished by simply stopping the noise **before** it enters the system. This discussion describes how external noise is introduced into systems by the **equipment interconnecting wiring,** and the improvements that can be realized by installing noise rejecting type cables, while applying good equipment isolation and grounding techniques.

Most electronic equipments do not produce random noise unto themselves and usually perform the singular task they were designed to do. When assembled and connected to other equipments to form a system, unwanted noise is picked up **by the interconnecting wiring** through the direct contact action of ground loops and common mode returns, or by inductive and capacitive pickup of nearby radiated fields. A desired signal in one circuit can be noise to another, and could be produced by local circuits within the system or from equipment completely removed and external to the system. Conversely, these same cables will **radiate** or **cross-talk** the signal they are carrying into adjacent circuits becoming themselves a **generator** of interference to other data systems, or the cause of security compromises in classified military communications. This action is further compounded by poor cable to equipment **impedance matching** which produces signal reflections and high standing wave ratios. In other words, **poorly selected and installed** cabling can act as both noise transmitting and receiving antenna or as undesired primary and secondary windings of coupling transformers, placing interference where it should not be.

Systems are often designed, fabricated, and installed using the simplest multiwire cable or grounded coax between equipment, racks, and buildings, not realizing that they will probably encounter and pick up all manner or interference. Nearby electrical equipment such as high power radar, broadcast stations, power distribution mains, fluorescent lighting, arcing motors, teletype, and communications circuits are but a few of the noisemakers. The lower the system signal voltage level, the greater is the susceptibility to this outside inter-

ference. A newly designed system might work fine on paper or when first assembled for checkout, but when installed at its final crowded location on ship or shore, just will not perform as anticipated. Only then is it realized that the completed system has picked up much noise and hum, or is itself radiating so heavily, that the equipment is unusable.

Costly additional effort, parts, and time must be expended to locate and attempt to eliminate the causes of the noise pickup, sometimes with little success. To avoid this unnecessary waste, cable to equipment interface engineering should be applied at the **start** of system planning and design. This applies to all systems irrespective of whether the signal is low or high frequency, or used in TV, telemetry, timing, ordnance, environmental testing, computer, telephone, test instrumentation, or just plain communications. Each system must be considered individually, since the signal frequencies and amplitudes **within the system** as well as the anticipated external interference will dictate what type of cabling and installation techniques are to be used.

Following are typical examples where good cable engineering is being applied. Low-level **environmental** systems predominately now use "guarded" balanced and shielded lines to transmit the calibrated transducer test voltage to an isolated charge amplifier. **TV video** is distributed over 124-ohm "shielded twisted pair" or twinax, instead of coax, in high noise areas to obtain the low frequency magnetic field crosstalk and hum cancellation provided by the "twist." Digital engineers in the **computer** and **instrumentation** fields must use good high-frequency design engineering to transmit nanosecond rise time pulses. A 10-nanosecond rise time pulse is equivalent to 100 megahertz RF and must be transmitted using the best coax cable techniques to avoid pulse reflection, false noise triggering or data inaccuracy. Special care will be required to keep noise from entering information systems, particularly aircraft. Low level communication circuits and cabling should be space separated and have effective shielding from adjacent parallel power circuits to avoid induced hum. Unprotected ordnance and timing circuits can receive false pulsing if exposed to external radiated RF interfering fields. High megawatt pulsed radar will introduce both its carrier and PRF into nearby sensitive low-level unprotected cable runs acting as receiving antennas. Sometimes the transmitted pulses have amplitudes of hundreds or thousands of volts, as used in **atomic energy testing** or linear accelerators, thereby producing large magnetic and capacitive interference fields. These in turn play havoc with local cable connected instrumentation and electronic equipment.

In the case of a nuclear attack, a tremendous electrical field will be transmitted many miles from ground zero to induce extremely high voltages in all unguarded and unprotected cable and equipment, with the resultant burnout of all sensitive components. Solid-state transistors and diodes, integrated circuits, front end R.F. coils, sensitive relays and reeds are typical of the sophisticated elements used today for both military and commercial systems that will fail far removed **from** the fireball area. It is estimated that a vertical electrical field intensity of 1500 volts per meter will be present 62.5 miles from a 10-megaton explosion near the ground. (Ref. 12)

In today's economy, the lack of money, time and qualified personnel will not permit the very complicated and costly post-completion interference cleanup of poorly engineered systems. Expensive electronic equipment handling low-level signals cannot be interconnected with the cheapest of cable and connectors and still be expected to work properly in a system. The use of coax, twinax, triax, or double shielded balanced line, "quadrax," in isolated or guarded circuitry, will do much to suppress outgoing EMI and RFI while reducing incoming unwanted noise pickup.

This protects both your system and the adjacent system from mutual interference. Obviously, careful cable to equipment interface planning must be exercised in the future to produce workable compatible systems, and design engineers will not be free to treat cable installation casually as in the past.

COAX CABLE

In all cases of potential interference, low or high frequency, shielded cable should be used to protect against magnetic and capacitive stray fields. Grounded coax cable installations are excellent and can be used from 20 KHz to 5 GHz for most systems. But even coax, if subjected to very strong interference will not completely protect the desired signal. Then, more sophisticated cable and equipment isolation techniques must be used dependent upon the frequency of the interfering noise and how it enters the cable system. What additional measures are taken to reduce noise will conversely reduce outgoing radiation and crosstalk.

GROUND LOOPS AND COMMON MODE RETURNS

Coax cable consists of an inner and an outer conductor insulated from each other, with both conductors carrying the desired signal currents (source to load and return). Inasmuch as the outer conductor is usually grounded at the source, load, bulkheads and other intermediate points, "ground loop" or "common mode" currents caused by potential differences of external noise sources are also carried on the outer conductor. Since the desired signal and the undesired noise are both carried on the same outer conductor simultaneously, noise will be introduced into the system, greatly reducing the "signal-to-noise ratio." Low frequency signals (20 KHz to 6 MHz) are particularly susceptible to both ground loop and common mode interference. In this case, coax cable is recommended with the complete coax chain having a **minimum** number of outer conductor ground contacts. Reducing the number of ground connections reduces the number of possible ground loops. This demands that major equipment, relays, switches, connectors, patch panels, etc., be **isolated from ground** with the ultimate being one system ground connection at the source.

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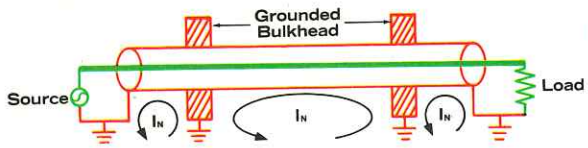
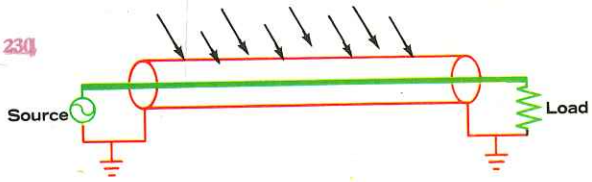
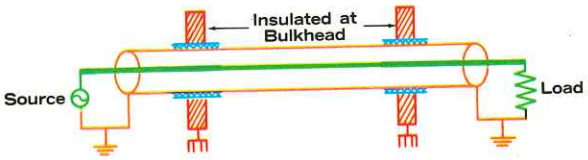


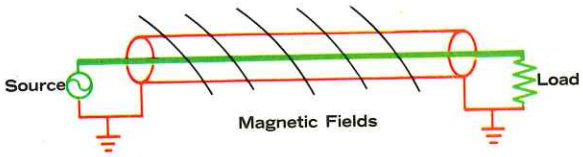
Non-Insulated Feed Thru Multiple Noise Currents (I_N)



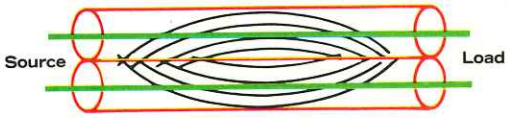
RF Interference (Cable acts as antenna)



Insulated Feed Thru No Noise Currents (I_N) in Signal Return



BJ-27
Insulated bulkhead jack for use in high noise systems where ground loops and common mode returns are prevalent.



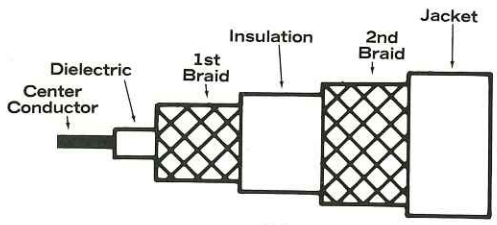
Crosstalk

BJ-28
Same as BJ-27 except double ended feedthru.

RADIATED FIELDS

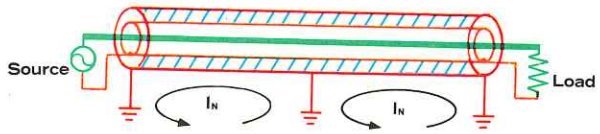
Where strong radiated noise fields exist, such as high-powered radar, broadcast stations, power lines, fluorescent lighting, office and industrial machinery, multiple cable runs, etc., the cable conductors act as receiving antennas or secondary windings of transformers and pick up the external noise sources. A particularly bad source of noise pickup is the "crosstalk" or induced currents encountered in large multiple cable installations. To protect against these radiated noise sources, two types of improved cable are used:

(1) Triax Cable — Triax cable is coax cable with an **additional outer copper braid** insulated from the signal carrying conductors that acts as a true shield and protects the enclosed coax conductors. This braid or shield is grounded and bypasses both **ground loop** and **capacitive field** noise currents away from the signal carrying coax, thereby greatly improving the "signal to noise" ratio over standard coax cable usage. Triax cable is also used in "Driven Shield" applications where the inner conductor and first shield are driven in parallel at the transmitting end and work against the outer braid which is insulated above ground. At the receiving end, the inner braid is left floating providing a "Faraday" shield between the inner conductor and outer braid. In this way, the cable **distributed capacity** is greatly reduced thereby reducing cable losses and loading. This application is most effective in low frequency transducer data systems where the distributed capacity in coax cable limits the data capability. (Page 129, Reference #1) Still another use for triax is to use only the two outer braids as a low impedance transmission line (approximately 12 ohms) which can be used to carry high-current pulses to low impedance laser lamps or exploding bridge wire (EBW) ordnance systems. Triax cable and connectors completely **insulated** from ground are available for these applications.

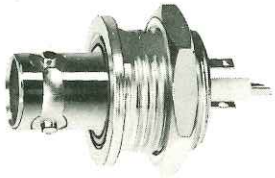


Triax Cable

PL-75
Twinax concentric plug that will mate with shielded two conductor twisted balanced wires. The twinax cable provides cancellation of random induced noise.

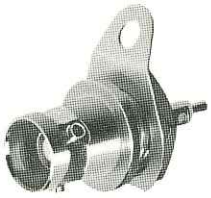


Triax Cable Provides Additional Shield, Insulated from Signal Carrying Coax



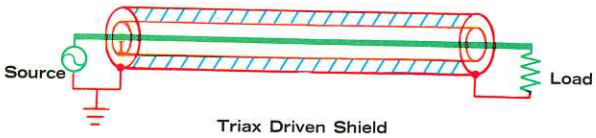
BJ-72
Concentric twinax and triax bulkhead jack that has all 3 circuits above ground providing "guarded" circuit and single point grounding capability.

PL-76
Triax plugs for use in "shielded" coax systems for protection against radiated fields and common mode noise.

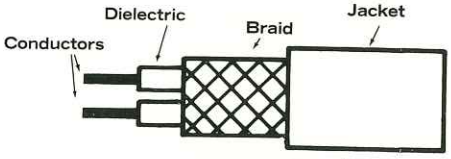


BJ-77
Bulkhead triax jack mates with PL-76 above.

(2) Twinax Cable — Twinax cable is a two-conductor twisted balanced wire line having a **specific impedance,** with a shielding braid around both wires. Twisting the two balanced signal carrying wires provides cancellation of any random induced noise voltage pickup, thereby giving protection against **magnetic** noise field of the low-frequency variety that passes through the copper braid. This cable also provides protection against ground loops and capacitive fields, as did triax cable. Twinax cable usefulness, however, is limited to approximately 10 MHz since it has rather high transmission losses above this frequency. 124 ohm twinax is extensively used by the Bell Telephone System for TV video transmission. Twinax cable and concentric connectors are available for low frequency and video distribution systems. (Paragraph 4 and 6 Reference #1)

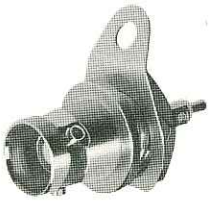


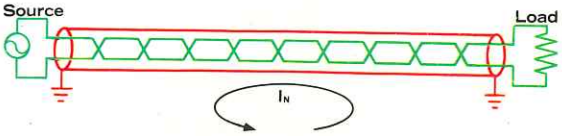
Triax Driven Shield



Twinax Cable

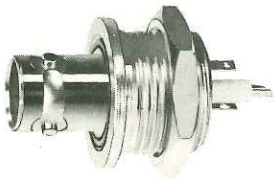
BJ-77
Bulkhead twinax jack mates with PL-75. Solder terminations are provided for easy termination and shield integrity is maintained throughout.





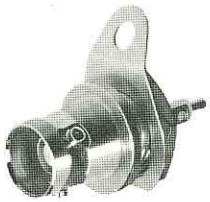
Twinax Cable Provides A Shield, Insulated from Twisted Pair Signal Carrying Conductors

PL-76
Triax plugs for use in "shielded" coax systems for protection against radiated fields and common mode noise.



BJ-72
Concentric twinax and triax bulkhead jack that has all 3 circuits above ground providing "guarded" circuit and single point grounding capability.

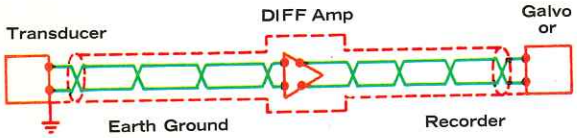
BJ-77
Bulkhead triax jack mates with PL-76 above.



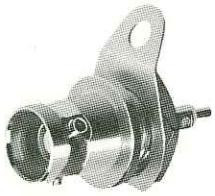
GUARDED TWINAX CABLE HOOKUP

(Paragraph 4 and 6 Reference #1)

Additional **common mode rejection** of noise can be obtained in instrumentation systems, where thermocouple and other transducer information must be remotely recorded, by using twinax with only one ground contact located at the transducer. **Insulated** concentric twinax connectors are available.



Cable System (one ground)
Guarded Twinax



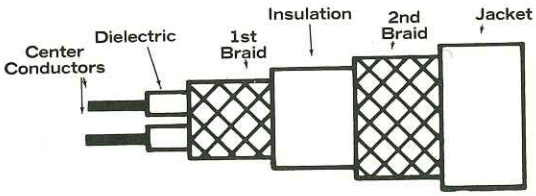
BJ-77
Bulkhead jack mates with PL-75 and PL-76.

QUADRAX GUARDED CIRCUIT

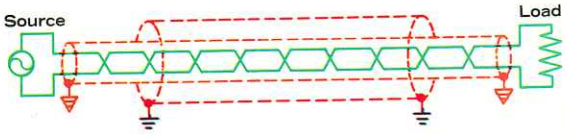
(Page 77, Reference #1)

For the ultimate in flexible cable protected and guarded circuits, twinax cable with **two** separate and insulated braids (quadrax) can be used wherein the two braids are connected to "system" ground and "earth" ground, respectively.

Quadrax cable can also be used to provide additional noise and EMI suppression by connecting both shielding braids to earth ground at one place if a separate equipment ground is not available. The inner braid is left floating above ground at all other locations to act as a Faraday shield and provide additional circuit isolation. Coax cable with **two** extra and insulated braids can be used in similar engineering concepts for unbalanced systems.



Quadrax Cable

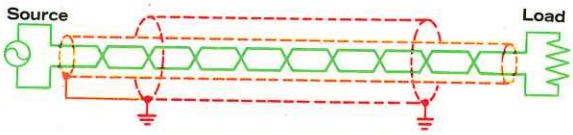


Quadrax Guarded Circuit

BJ-101
Bulkhead mounting quadrax connectors require no mechanical orientation to mate due to the concentric design. Solder terminals are provided for easy termination and shield integrity is maintained throughout.

PL-101
Quadrax plug will accept cable sizes up to .280 diameter. The concentric connector will mate with the BJ-101 and double ended feedthru BJ-102.

BJ-102
Concentric quadrax connectors are used where the ultimate in noise and EMI suppression is required. The double ended feedthru is used where passing thru a bulkhead will not disturb the shield integrity.



Quadrax Guarded Circuit

BONDING AND GROUNDING

Good bonding and grounding are absolutely essential also if noise pickup reduction is to be accomplished. Much has been written to define the correct methods to accomplish both with some suggested reading material being listed in the bibliography. It is desired to point out here that equipment isolation cabling, bonding, and grounding are all part of the noise pickup and EMI/RFI problem.

Following are some conditions that require detailed investigation:

1. "Earth" grounds require extensive grids, ground rods, and chemical preparation to obtain an extremely low resistance and impedance system ground return.

2. Where equipments comprising a low frequency data system are widely separated, equipment ground "planes" in many instances should be isolated from earth grounds to avoid "noisy" ground loops caused by power and other equipment in the immediate area.

3. If parallel cabling is necessary, space separate cabling of similar functions, i.e., R.F from R.F., video from video, and cables carrying vastly different voltage levels so that they do not have mutual capacitive or inductive coupling.

4. Properly terminate all pulse and high frequency cables in their characteristic impedance so that the cable reactive components are cancelled out and the voltage standing waves are reduced to a minimum.

5. Select the proper cable for the job. The higher the frequency, the faster the pulse rise time, or the longer the cable run, the bigger the cable must be to reduce dielectric losses and lessen the distortion of pulse shapes.

6. If "system" ground and "earth" ground must be connected, it should be done at minimal locations (preferably one) using extremely low-impedance bonding paths and materials. On the other hand, R.F. and high frequency bonding should be made quite frequently to provide the shortest R.F. path to ground and prevent the ground return from acting as an additional length of antenna. **To repeat, the method of equipment interconnecting and grounding is a function of the signal frequency (L.F., video or R.F), and no one simple answer can be provided.**

COMPONENTS AND EQUIPMENT AVAILABLE

Trompeter Electronics is primarily concerned with supplying interface and programming hardware necessary to complete any protected low or high frequency system. This includes coax, triax, twinax and quadrax connectors, patch panels and complete switching systems. The catalog lists standard system hardware available to accomplish specific tasks. Our technical staff is available to assist in selection of these components and to help in providing any components not shown.

This discussion was not intended to be a full text, but to give some insight into what must be done to produce noise free systems without extensive rework and debugging. Many extensive and enlightening articles and books have been written, a few being listed below. They in turn list other references that should be studied for more detailed information. Reference (1) and (2) are readily available from the publishers.

BIBLIOGRAPHY

1. Grounding and Shielding Techniques in Instrumentation, Ralph Morrison, Wiley & Sons, New York.

2. Electrical Interference, R. F. Ficchi, Hayden Book Co., New York.

3. University of California Lawrence Radiation Laboratory, Engineering Note LEN 22163, Dated 7/18/68 L. R. Allen.

4. Dana Labs, Inc., Irvine, California, Technical Paper No. 521, December 1965.

5. Brush Instruments Article in Measurements & Data, May/June 1968 — Author, D. H. Nalle.

6. Hum Reduction in Video Systems, Dynair Electronics, San Diego — D. A. Keller.

7. Eliminate RFI in Audio Circuits, Broadcast Engineering Magazine, January 1972.

8. Interference Coupling — Attack It Early, Richard J. Mohr, Cutler-Hammer, Inc., EDN Magazine, July 1, 1969, Vol. 14, No. 13.

9. Analysis of Cable-Coupled Interference, by L. J. Greenstein and H. J. Tobin, IEEE Trans. Radio Frequency Interference, Vol. RFI-5, March 1963, pp. 43-55.

10. Crosstalk Between Coaxial Transmission Lines, by S. A. Schelkunoff and T. M. Odarenko, Bell Systems Technical Journal, Vol. 26, April 1937, pp. 144-164.

11. Cabling Fast Pulses? Don't Trip on the Steps! Thad Dreher — Electronic Engineer/August 1969.

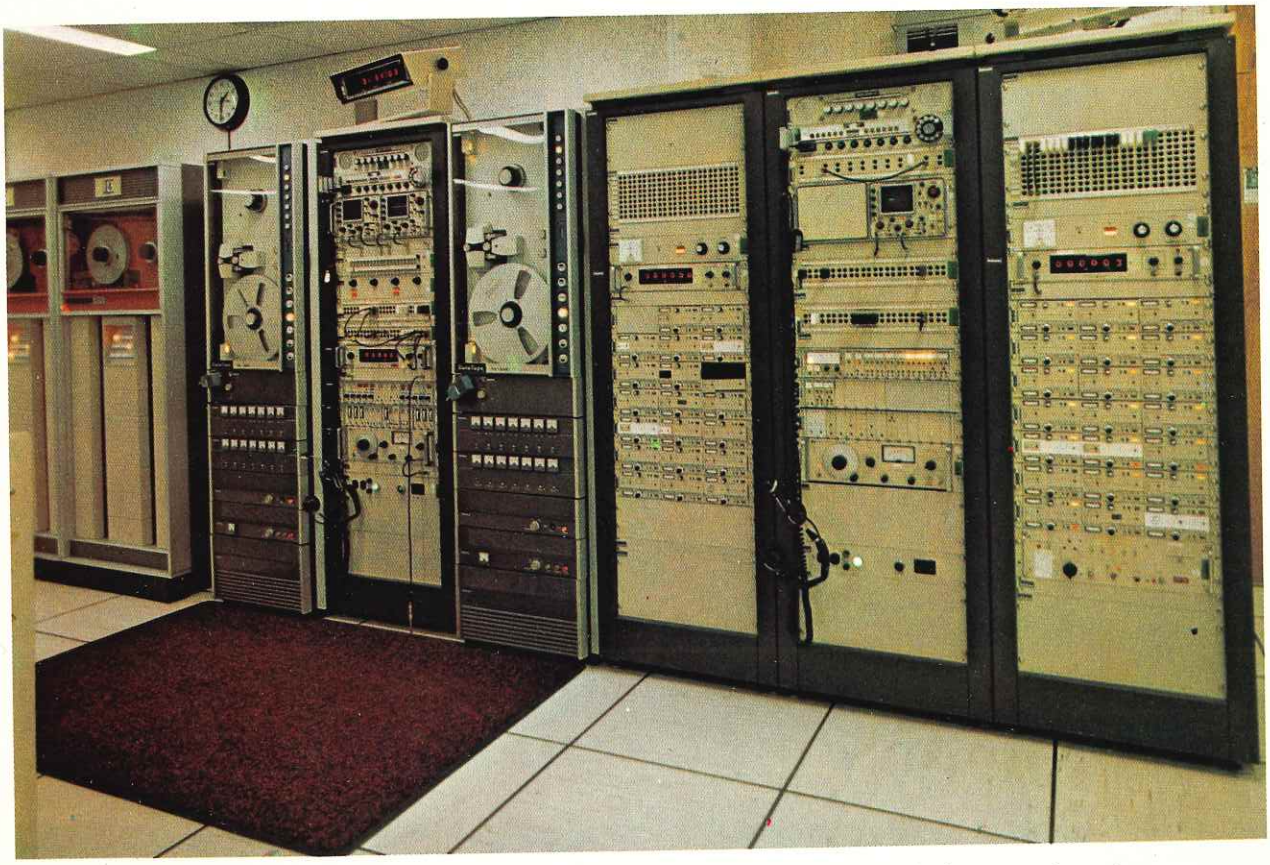
12. Designing for the Worst of Worst Cases — Nuclear War by C. F. Johnson, Buena Park, Calif. Member TRW Technical Staff Electronics/August 21, 1967.

13. EMP Protection for Emergency Operating Centers, TR-61A, May 1971 — Govt. Printing Office 1971-0-421-597.

14. Controlling Interference in Microwave Design, R. J. Mohr, Microwaves Magazine, November 1971.

15. Techniques to Analyze and Optimize noise rejection ratio of low level differential data systems, Charles E. Engle Staff Engineer Dana Laboratories Inc., Irvine, California Technical paper number 521, December 1965.

16. MIL-STD-461A.



Complete data acquisition system utilizing noise reduction techniques and equipment, both patching and switching, illustrated in subsequent sections of this catalog.

PATCHING

STANDARD PATCH PANELS

ORDERING INFORMATION

PANELS AND JACKS ARE SELECTED SEPARATELY AND COMBINED FOR ONE PART NUMBER

(Select type of panel, the appropriate jack and combine as shown.) Custom panels can be fabricated to special order. See Catalog pages 41 & 42.

JS — 12 / J3

JS indicates all aluminum panel (common ground)

JSI insulated panel

Number of jack holes

Type of jack selected

PANEL SPECIFICATIONS

SIZES: 19" wide, 3/16" thick, 1¾" (single row) or 3½" (double row) in height. Other sizes available on special order.

NOTCHING: In accordance with Mil-Std.-189 ("Universal" spacing to special order).

FINISH: Color 111 of Mil-E-15090. Special paint finishes available. Order matching colors shown in Fed. Std. 595.

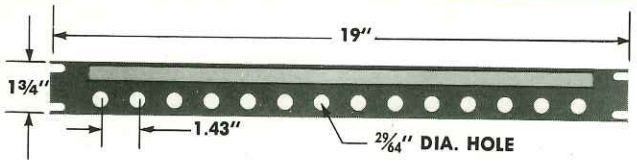
MATERIAL: JS SERIES—Common ground panels. Front panel and back mounting bar are aluminum grade 6061T6.

JSI SERIES: Insulated panels. Front panel is aluminum grade 6061T6 with back mounting bar of phenolic material. Nylon sleeves insulate the body of the jacks from the front aluminum panel. Insulated patch panels are recommended where ground loops are to be avoided. (See technical discussion beginning page 1).

PLATING: Jacks, plugs and connectors, except those illustrated on pages 17 thru 21 are gold (.000050) over copper (.000080) over base brass. Others as indicated are bright nickel (.00010) over copper (.000080) over base brass.

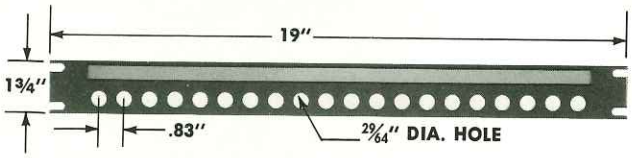
MARKING STRIPS FOR PANELS

IDENTIFICATION: Each panel is equipped with 9/16" x 16½" stainless designation strips (DS-1) with ½" I.D. card and plastic window. ¾" strips (DS-2) available on special order. Engraving or silk screening can also be provided to customer specification in place of designation strips.



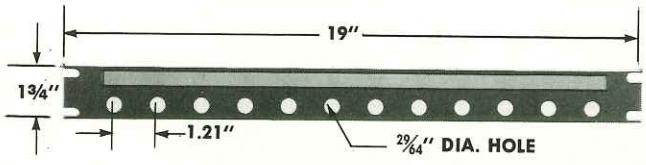
JS-12 12 jacks
JSI-12 (same, insulated panel)

Accepts all jacks except J-14, J-15 Series



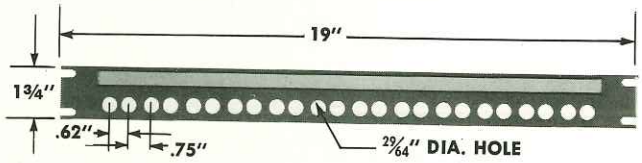
JS-20 20 jacks
JSI-20 (same, insulated panel)

Accepts all jacks except J-14, J-15 Series



JS-14 14 jacks
JSI-14 (same, insulated panel)

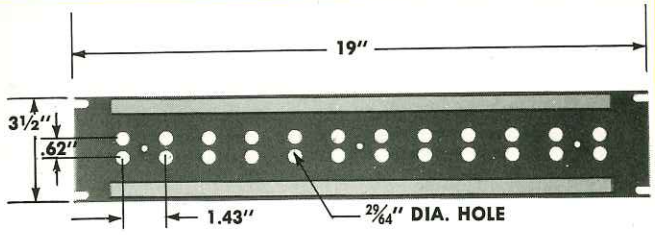
Accepts all jacks except J-14, J-15 Series



JS-24S 24 jacks
JSI-24S (same, insulated panel)

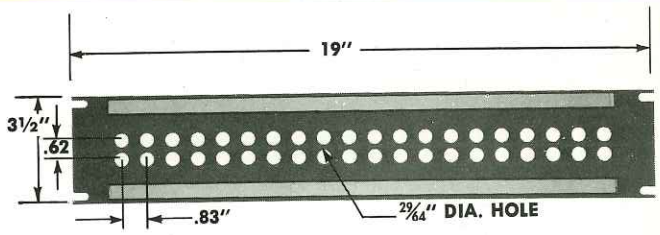
Accepts all jacks except J-2, J-4, J-9, J-14, J-15 Series

STANDARD PATCH PANELS



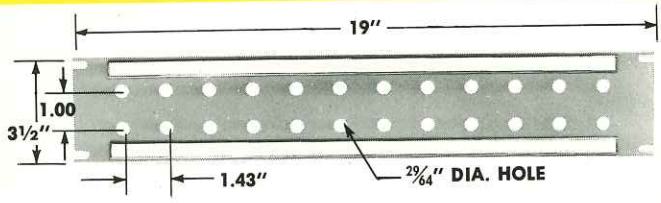
JS-24L 24 Jacks
JSI-24L (same, insulated panel)

Accepts all jacks except J-2, J-4, J-9



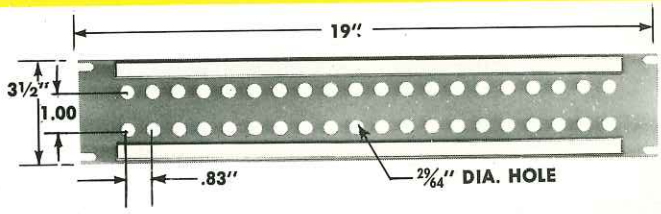
JS-40 40 jacks
JSI-40 (same, insulated panel)

Accepts all jacks except J-2, J-4, J-9



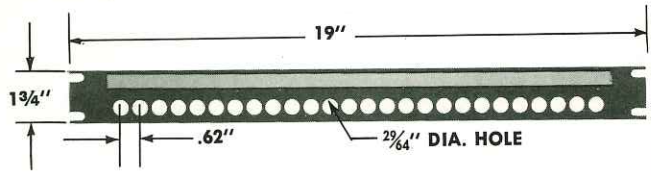
JSW-24 (Same as above except vertical hole centers 1.00")
JSWI-24 (same, insulated panel)

Accepts all jacks except J-14, J-15 Series



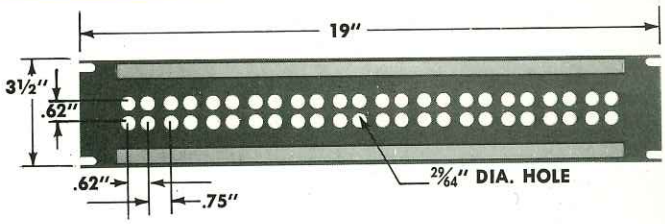
JSW-40 (same as above except vertical hole centers 1.00")
JSWI-40 (same, insulated panel)

Accepts all jacks except J-14, J-15 Series



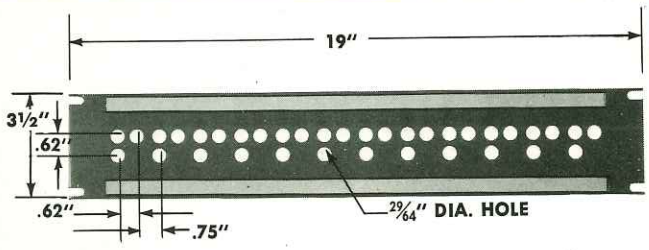
JS-26 26 jacks
JSI-26 (same, insulated panel)

Accepts all jacks except J-2, J-4, J-9, J-14, J-15 Series



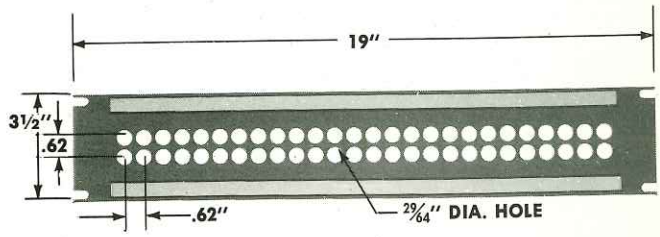
JS-48 48 jacks
JSI-48 (same, insulated panel)

Accepts all jacks except J-2, J-4, J-9



JS-36 36 jacks
JSI-36 (same, insulated panel)

Accepts all jacks except J-2, J-4, J-9



JS-52 52 jacks
JSI-52 (same, insulated panel)

Accepts all jacks except J-2, J-4, J-9

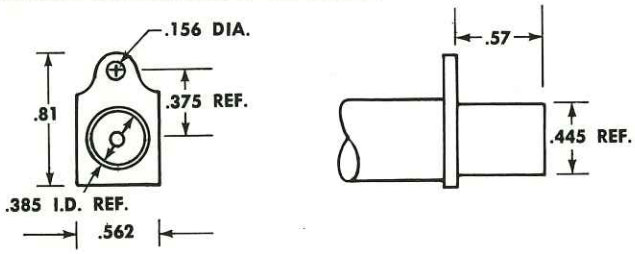
STANDARD PANEL JACKS (COAXIAL)

INTRODUCTION

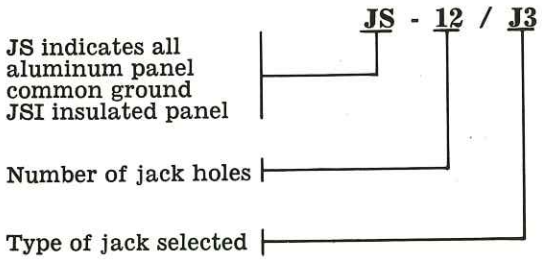
The pictured jacks provide the maximum flexibility to route signals from one place to another. They are used in shielded wire, video, and R.F. applications, and will mount on patch panels illustrated on the preceding pages. The jacks can be intermixed on the same panels providing mechanical limitations be recognized.

Also, coax jacks shown are available in two standards differing in the size of the center contact pin — Western Electric is .090", RCA is .070". It should be noted that Western Electric type jacks must be used only with WE type patch cords and conversely, RCA type jacks must be used only with RCA type patch cords.

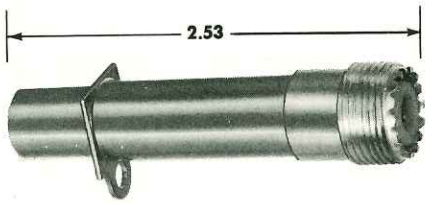
JACK MOUNTING DETAIL



SELECT THE JACK FOR THE PANEL TO FORM A COMPLETE PART NUMBER



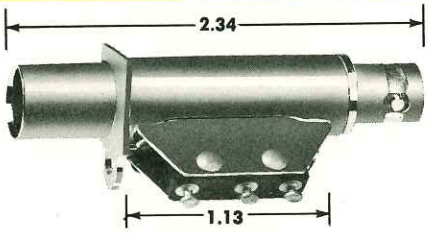
For compatibility with Western Electric Company and Lenkurt Electric Company precision 75 ohm patching (see page 37).



PART NO. J2 for .070" pins (RCA)
J2W for .090" pins (W. E.)

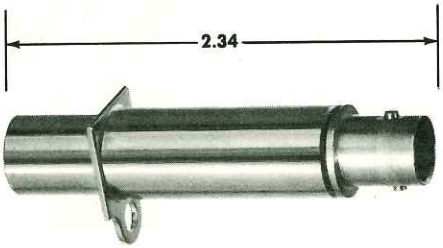
Rear mates with any UHF cable plug of the PL-259 type.

Usable on JS/JSI 12, 14, or 20, JSW-24 & JSW-40 jack panels only.



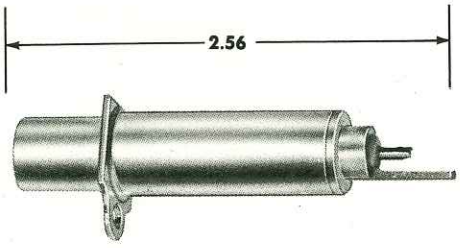
PART NO. J3A for .070" pins (RCA)
J3AW for .090" pins (W. E.)

J3 with:
External SPDT microswitch. Activated by insertion of patch plug. Switch can be installed on all jacks except miniature series and concentric types. Rear mates with same as J3 jack.



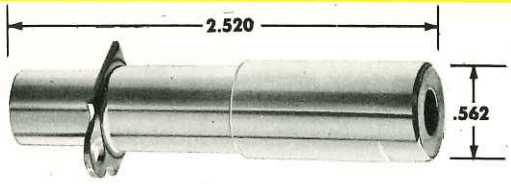
PART NO. J3 for .070" pins (RCA)
J3W for .090" pins (W. E.)

Rear mates with Trompeter plugs PL-23 thru PL-29 or any standard BNC plug.



PART NO. J3D for .070" pins (RCA)
J3DW for .090" pins (W. E.)

STANDARD PANEL JACKS (COAXIAL)

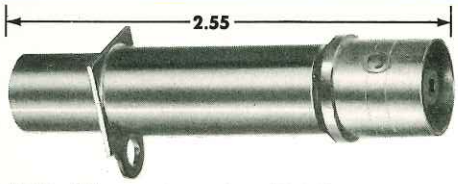


PART NO. J3E *N for .070" pins (RCA)
J3EW *N for .090" pins (W. E.)

Usable whenever cable entry is required in place of standard connectors. Assembly is the same as BNC series illustrated on page 17.
* Substitute cable group number in place of N.

COAXIAL CABLE GROUPS

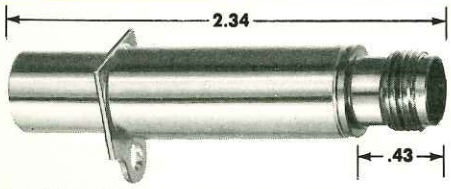
JACK PART NUMBER	CABLE GROUP	DIA.	CABLE	NOM. IMP.
J3E-1/J3EW-1	1	.195	RG-58/U	50Ω
J3E-1/J3EW-1	1	.195	Essex 621-715	75Ω
J3E-1/J3EW-1	1	.195	Essex 21-537	50Ω
J3E-2/J3EW-2	2	.242	RG-59/U	75Ω
J3E-2/J3EW-2	2	.242	RG-62/U	93Ω
J3E-2/J3EW-2	2	.242	RG-71/U	93Ω
J3E-2/J3EW-2	2	.242	Belden 8211	80Ω
J3E-2/J3EW-2	2	.242	Belden 8212	75Ω
J3E-2/J3EW-2	2	.242	Belden 8217	80Ω
J3E-2/J3EW-2	2	.242	Essex 621-186	75Ω
J3E-2/J3EW-2	2	.242	Essex 21-959	73Ω
J3E-2/J3EW-2	2	.242	Essex 21-541	73Ω
J3E-2A/J3EW-2A	2A	.220	Belden 8279	75Ω
J3E-2A/J3EW-2A	2A	.220	RG-55/U-RG-55B/U	53Ω
J3E-12B/J3EW-2B	2B	.250	Western Electric 730A	75Ω
J3E-3/J3EW-3	3	.216	RG-223/U	50Ω
J3E-3/J3EW-3	3	.216	RG-55A/U	53.5Ω
J3E-4/J3EW-4	4	.160	RG-122/U	50Ω
J3E-4/J3EW-4	4	.160	RG-195/U	95Ω
J3E-4/J3EW-4	4	.160	Essex 21-597	75Ω
J3E-4/J3EW-4	4	.160	Essex 421-111	95Ω
J3E-4/J3EW-4	4	.160	Belden 8218	75Ω
J3E-5/J3EW-5	5	.100	RG-174/U	50Ω
J3E-6/J3EW-6	6	.304	Western Electric 724/728	75Ω



PART NO. J4 for .070" pins (RCA)
J4W for .090" pins (W. E.)

Rear mates with any type "C" UG connector plug.

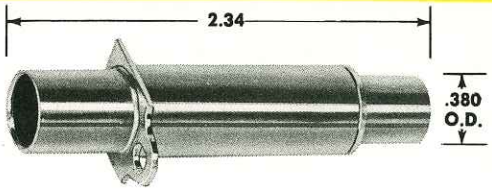
Usable on JS/JSI 12, 14, or 20, JSW-24 and JSW-40 jack panels only.



PART NO. J5 for .070" pins (RCA)
J5W for .090" pins (W. E.)

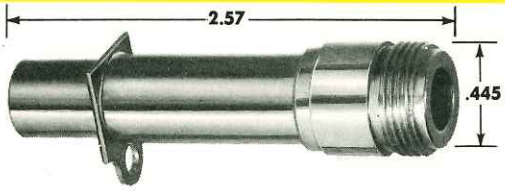
Rear mates with any "TNC" type UG connector and Trompeter plugs PL-45 through PL-49.

Usable on JS/JSI 12, 14, or 20, JSW-24 and JSW-40 jack panels only, however, if Trompeter PL-45 through 49 series used, jack usable on all panels.



PART NO. J6 for .070" pins (RCA)
J6W for .090" pins (W. E.)

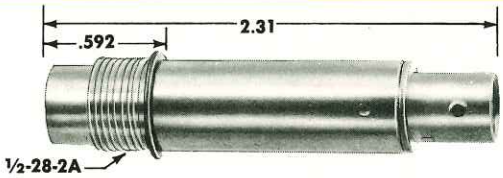
Same as J3 only rear mating connector designed to accept standard "BNC" or "TNC" plugs as "push on" coupling — "snaps" into mated position.



PART NO. J9 for .070" pins (RCA)
J9W for .090" pins (W E.)

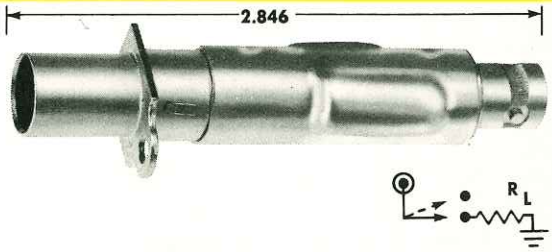
Rear mates with any type "N" UG plug.

Usable on 12, 14, or 20 JSW-24 and JSW-40 jack panels only.



PART NO. J10 for .070" pins (RCA)
J10W for .090" pins (W. E.)

Same as J3 except:
Mounting flange has been eliminated. Front end is threaded into tapped panel hole permitting high density mounting.



PART NO. J13-R* for .070" pins (RCA)
J13W-R* for .090" pins (W. E.)

Incorporates ½ watt 2% resistor for circuit termination when patch cord is not inserted. Shield cover is placed over resistor to maintain shield integrity.

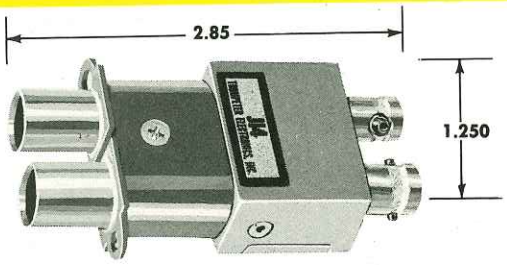
* Substitute resistance value for "R" i.e., J13-75. Also available with "TNC" on special order. Not recommended for use above 60 MHz.

PANEL JACKS (COAXIAL)

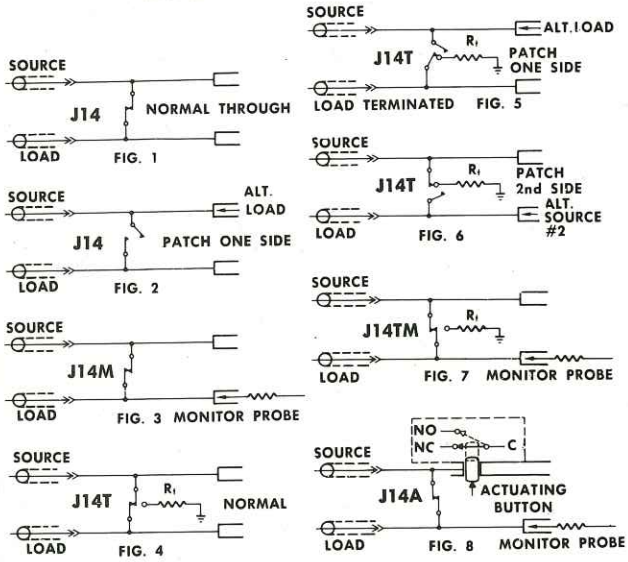
PART NO. J13A-R .070" pin (RCA)
J13AW-R .090" pin (W. E.)

Same as J13-R except it has a SPDT switch to activate a power source, control circuit or low frequency signal. Switch can carry 7 amps at 100 VAC resistive. Activated by insertion of a patch cord.

Not recommended for use above 60 MHz.



PART NO. J14 .070" (RCA)
J14W .090" (W E.)



J14 SERIES

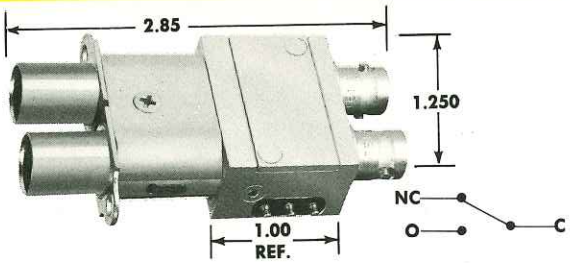
The J14 series is a dual coax jack the purpose of which is to automatically provide a "normal thru" signal path without the use of looping plugs or patch cords. The normalling switch contacts utilize a unique self-wiping action for positive contact. Each jack contains a lever operated switch that is activated by the side of the plug barrel, which eliminates premature normalling. The signal path and self-termination features of the various jacks are described below.

J14 has normal through connections to eliminate the need for looping plugs. Insertion of the patch cord breaks the "norm" (Fig. 2) and allows temporary rerouting of signals.

J14M permits sampling or testing normal through without interruption or loading of signal (Fig. 3 and 7).

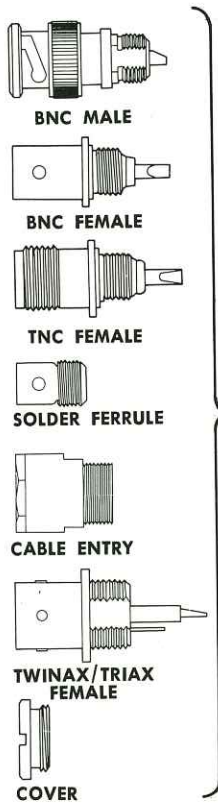
J14T is the same as J14 except when patch cord is inserted in either jack, termination is then accomplished in the opposite jack (Fig. 5 and 6). When patch cords are inserted in both jacks, no termination occurs (Fig. 7).

J14 series accepts same patch cords, test probes, and other ancillary equipment, making it permissible to have a mixed patch field.

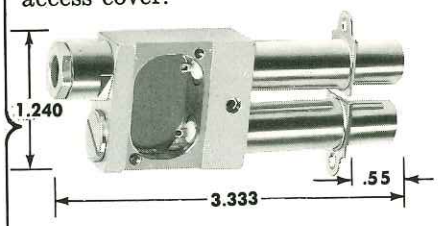


PART NO. J14A .070" pin (RCA)
J14AW .090" pin (Western Electric)

Same as J14 except incorporates a SPDT switch to activate a power source control circuit or low frequency signal. Switch can carry 7 amps at 100 VAC resistive. To activate the SPDT switch, patch plug is inserted in opposite jack. Microswitch can be installed in any of the J14 series. The addition of the letter "A" indicates external SPDT. (Fig. 8). Not recommended for use above 60 MHz.



Dual coax jack with two cable entrances. Various accessories permit acceptance of most coax or twinax cables of .420 or smaller. Cable entry is the same as BNC types illustrated on page 17. Any combination of coax or twinax input is available. Networks can be designed into the main block as required. Simply remove the 2 screws from the access cover.



This dual jack is mounted on ⅝" horizontal centers with mounting lugs back to back or the mounting lugs may be rotated side by side for vertical mounting.

For further information contact the factory direct.

NOT RECOMMENDED FOR USE ABOVE 100 MHz.

J — 15 — 1 — OR — C

J15 (.070 RCA)
J15W (.090 WE)

Cable Entry Cable Group

Type of Cable or Connector

Connector Type Required

Not recommended for use above 60 MHz.

PATCH CORDS and PLUGS (COAXIAL)

INTRODUCTION

Trompeter has established facilities and techniques to manufacture coax cable assemblies rapidly and efficiently. Automatic measuring, cutting, stripping and testing provide the customer with definite quality and cost advantages. The coax patch plugs shown are available in two standards differing in the size of the center contact pin — Western Electric is .090", RCA is .070". It should be noted that Western Electric type plugs must be used with only WE type patch jacks and, conversely, RCA type plugs must be used with only RCA type patch jacks.

Standard patch cords are 6, 12, 18, 24, and 36 inches long, measured from hub to hub. and are made from RG58/U (50 ohm), RG59/U (75 ohm) and RG62/U (93 ohm). Other lengths may be ordered by substituting the desired length in the part number. Other connectors and coax cables are available on special order.

Part Number
TYPE—L—Z

PC .070" pin (RCA)
PCW .090" pin (W. E.)

LENGTH IN INCHES

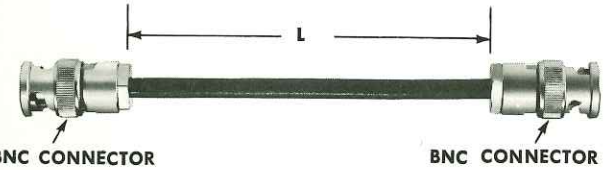
IMPEDANCE: 50, 75, 93Ω

Part Number
TYPE—L—Z

PCX .070" pin (RCA) & BNC plug
PCWX .090" pin (W. E.) & BNC plug

LENGTH IN INCHES

IMPEDANCE: 50, 75, 93Ω



Part Number
TYPE—L—Z

PCY (BNC plug)

LENGTH IN INCHES

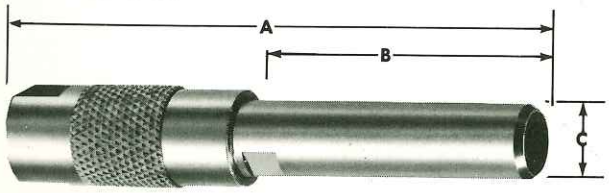
IMPEDANCE: 50, 75, 93Ω

TEST ADAPTER PLUG

AD-1 for .070" pins (RCA)
AD-1W for .090" pins (W. E.)

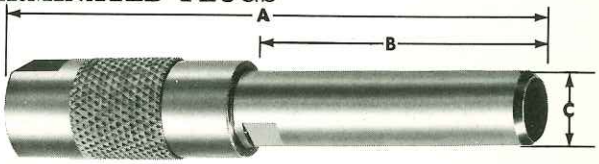
Rear mates with Trompeter Plugs.
PL-23 thru PL-29 or any standard BNC plug.

PATCH PLUGS



PART NUMBER	DIMENSIONS			CABLE GROUP	DIA.
	A	B	C		
PL-1	2.80	1.57	.375	1	.195
PL-1W	2.50	1.27	.375	1	.195
PL-2	2.80	1.57	.375	2	.242
PL-2W	2.50	1.27	.375	2	.242
PL-4	2.80	1.57	.375	3	.216
PL-4W	2.50	1.27	.375	3	.216
PL-5	2.438	1.188	.375	6	.304
PL-5W	2.438	1.188	.375	6	.304

TERMINATED PLUGS



TP-R* (RCA)
TPW-R* (W. E.)

Incorporates ½ watt 2% resistor and allows the termination of a circuit from the front of the patch panel.

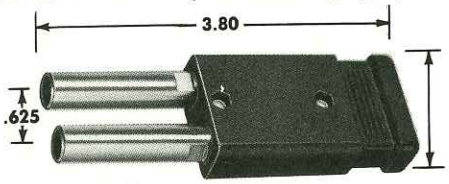
*Substitute resistance value in place of "R," i.e.: TP-75

PARALLEL PATCH CORDS AND PLUGS (COAXIAL)

INTRODUCTION

The accessories shown on Pages 15 and 16 are for front and back of panel additions that provide whatever items are needed for the more sophisticated patching systems. The items shown have proven most popular over the years. Modifications or redesign of these items provide special capability and can also be supplied on order.

LOOPING PLUGS (COAXIAL, 5/8")

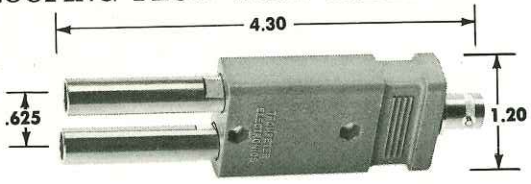


Color Coded Handle
50Ω: green
75Ω: violet
93Ω: white

Part Number
LP — Z

LP .070" pin (RCA)
LPW .090" pin (W. E.)
IMPEDANCE: 50, 75, 93

LOOPING PLUG WITH CABLE ADAPTER



Part Number
LPA — Z

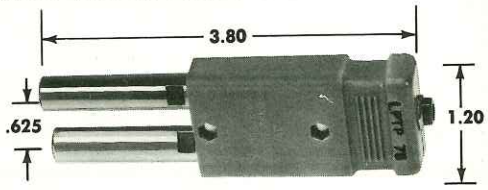
LPA .070" pin (RCA)
LPAW-Z .090" pin (W.E.)
IMPEDANCE: 50, 75, 93

BNC receptacle is mounted on rear end of looping plug and mates with any standard "BNC" UG plug. Not for use with JSW/JSWI-24 and JS/JSWI-40.

Other types of receptacles available on special order.

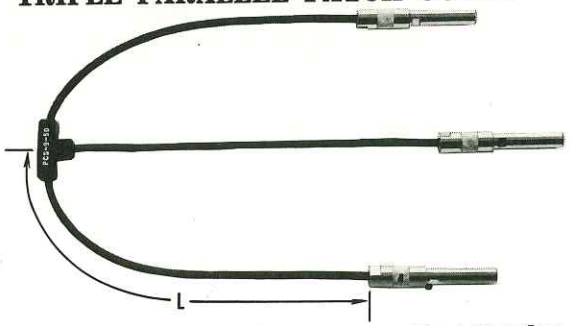
LOOPING PLUG WITH TEST POINT

Part Number
LPTP-Z
LPTPW-Z



Color Coded Handle
50Ω: green
75Ω: violet
93Ω: white

TRIPLE PARALLEL PATCH CORDS

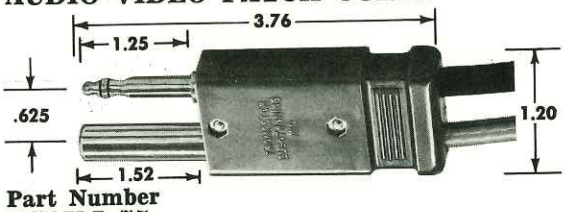


Part Number
PCS — L — Z

STANDARD LENGTH (L) IS 9"
PCS .070" pin (RCA)
PCSW .090" pin (W. E.)
LENGTH IN INCHES
IMPEDANCE: 50, 75, 93

The triple parallel patch cord, PCS-L-Z, is used where three coax cables in parallel will not cause a serious mismatch in impedance. The PCS-L-Z is not recommended for R.F. signals.

AUDIO VIDEO PATCH CORDS

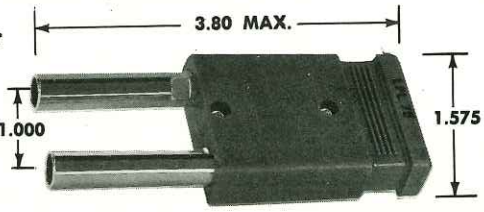


Part Number
PCAV-L-75

The audio and coax video patch cord will provide simultaneous audio and video patching for TV and other similar applications. The audio plug is a tip-ring-sleeve type using twisted pair shielded cable and the video plug is a PL-2 type with RG59/U cable. Standard patch cord lengths are available in 6, 12, 18, 24 and 36 inches measured from hub to hub. Other lengths are available by substituting the desired length in part number. Substitute length in inches from "L." Also available in bantam and 1 inch wide spacing.

LOOPING PLUG (WIDE SPACING, 1")

Part Number
LPL-Z
LPLW-Z

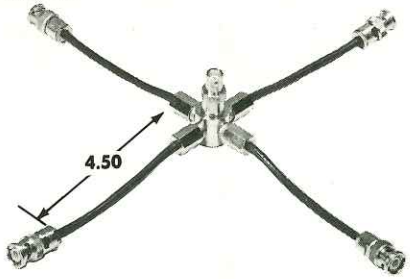


Color Coded Handle
50Ω: green
75Ω: violet
93Ω: white

For use with all JSW type panels. Also available with test point. (LPLTP-LPLTPW-Z)

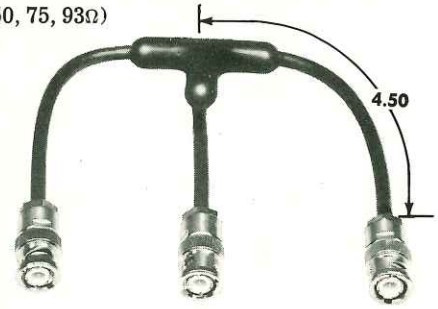
BNC PARALLEL NETWORKS

PN-4-Z (50, 75, 93Ω)



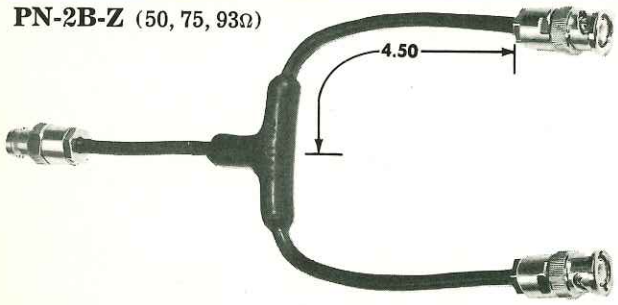
4 jacks, one input — random paralleling.

PN-3-Z (50, 75, 93Ω)



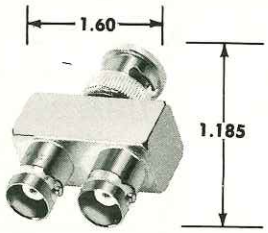
3 jacks, no input — random paralleling.

PN-2B-Z (50, 75, 93Ω)



2 jacks, one input — random paralleling.

PN-2A



1 jack, two input — fixed paralleling.

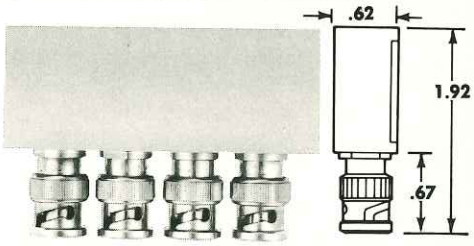
NOTE: Recommended for use on single row panels only.

Can be used on all panels except JS24L, JS-36, 40, 48, 52.

PNS AND PNSX

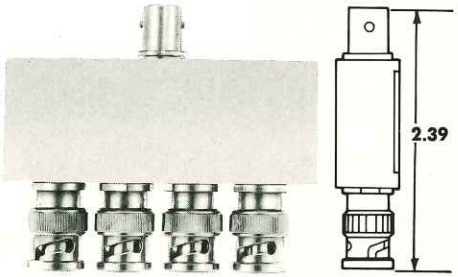
The PNS or PNSX can be fabricated to provide paralleling for any number of jacks, receptacles, or special networks per customer specifications. Pictured units provide paralleling for four (4) jacks. Panel type or spacing of the connectors **MUST** be specified. Other types of connectors such as TNC, TPS, SMA, etc., are also available.

PNSX-4



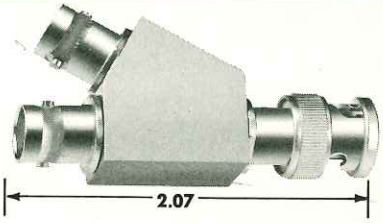
No input — 4 plugs.
Specify panel type or specify spacing.

PNS-4



One input — 4 — output
Specify panel type or specify spacing.

PN-2C



Same as PN-2A except can be used with high density panels.

PN-2

2 jacks, one input — fixed paralleling.

For spacing other than .625 see PNS series above.

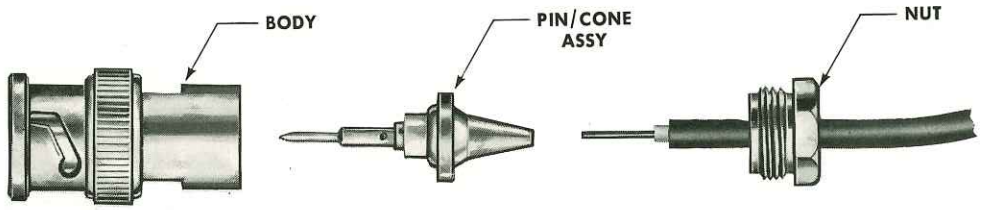
COAXIAL CONNECTORS—UNICUT DESIGN

WITH FAST 3-PIECE ASSEMBLY... MEETS MIL-C-39012, CATEGORY "A" (FIELD REPLACEABLE WITH ORDINARY TOOLS)

The old "UG" coax connectors required several cutting and stripping assembly operations, demanding precise and time-consuming steps to attach to the cable.

Crimp type connectors require a very expensive tool for assembly and are not readily field replaceable. The new "unicut" design reduces the assembly time to a fraction of the old "UG" method, provides greater mechanical strength at the cable entry, and requires no costly tools to assemble. The unicut connector can be completely disassembled and reused many times since it does not contain any rubber gaskets or crimped parts.

The center contact is captive and automatically positioned correctly upon assembly and cannot drift. The back nut with inside lands provides a moisture barrier, and is designed to withstand a 90 pound pull test. The unicut connector will withstand severe use and is available in BNC, TNC, TPS, N, and C styles for all types of RG cable. As an added feature, the center conductor pin for all coax connector sizes can be crimped using Buchanan crimp tool #613439.

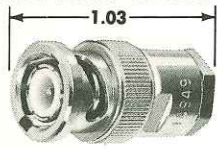


INSTRUCTIONS FOR ASSEMBLY OF COAXIAL CONNECTORS TYPES: BNC/TNC/TPS

1. Slip back nut onto cable.
2. Make a clean perpendicular cut through cable jacket, braid and dielectric, exposing 5/16" of center conductor.
3. Cut jacket back an additional 1/32 of an inch and bend braid outward to allow free entry of cone. This will prevent cone from forcing braid up under jacket.
4. Lightly tin center conductor.
5. Insert center conductor and dielectric into pin and cone assembly. Push edge of cone between dielectric and braid. Tapered cone will flair out braid and jacket. Continue to push cable into the cone until braid seats against shoulder. The center conductor should be visible in the pin solder hole.
6. Solder center conductor to pin.
7. Bring back nut up onto tapered portion of cable.
8. Assemble body over pin/cone assembly and engage with backnut.
9. Tighten assembly by holding backnut rigid and rotating body clockwise. This prevents cable from twisting and breaking center conductor.

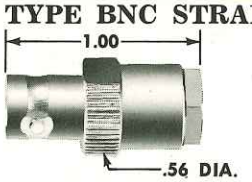
COAXIAL CONNECTORS

TYPE BNC PLUG



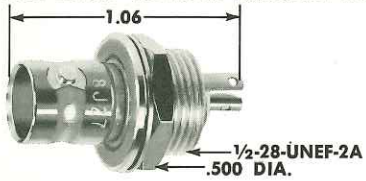
PART NO. PL-23 THRU PL-29 (see table below)

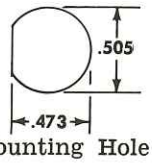
TYPE BNC STRAIGHT CABLE JACK



PART NO. J-20 SERIES (see table below)

TYPE BNC RECEPTACLE INSULATED



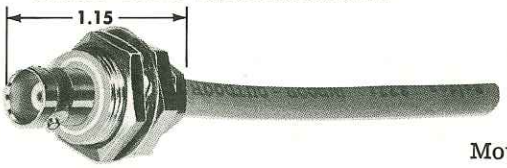


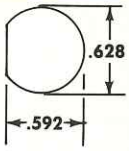
Mounting Hole

PART NO. BJ-27
(with shield solder lug)

Max. panel thickness .300

TYPE BNC RECEPTACLE

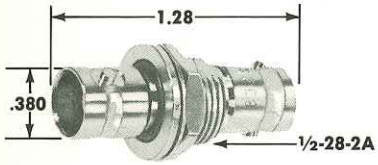


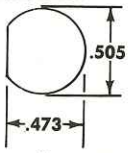


Mounting Hole

PART NO. BJ-26
BNC (insulated cable input jack).
Variations of these receptacles are available on special order in reasonable quantities.
Max. panel thickness .350. See table for — number.

TYPE BNC RECEPTACLE INSULATED



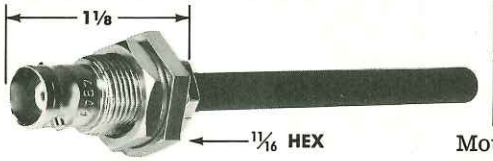


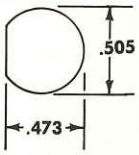
Mounting Hole

PART NO. BJ-28
(double-ended feed-thru, insulated from chassis)

Max. panel thickness .300

TYPE BNC RECEPTACLE





Mounting Hole

PART NO. BJ-29
BNC (non-insulated cable input jack).
Variations of these receptacles are available on special order in reasonable quantities.
Max. panel thickness .375. See table for — number.

HIGH VOLTAGE MHV PLUG 5KV

PART NO. PL-119 —Cable Group

HIGH VOLTAGE MHV RECEPTACLE 5KV

PART NO. BJ-119

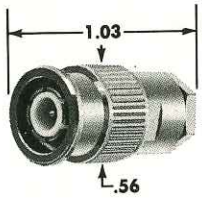
CONNECTOR — PART NUMBERS				CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-27	BJ26-1	BJ29-1	J27	1	.195	RG-58/U	50Ω
PL-27	BJ26-1	BJ29-1	J27	1	.195	Essex 621-715	75Ω
PL-27	BJ26-1	BJ29-1	J27	1	.195	Essex 21-537	50Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	RG-59/U	75Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	RG-62/U	93Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	RG-71/U	93Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	Belden 8211	80Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	Belden 8212	75Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	Belden 8217	80Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	Essex 621-186	75Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	Essex 21-959	73Ω
PL-28	BJ26-2	BJ29-2	J28	2	.242	Essex 21-541	73Ω
PL-23	BJ26-2B	BJ29-2B	J23	2B	.250	Western Electric 730A/731	75Ω

CONNECTOR — PART NUMBERS				CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-24	BJ26-3	BJ29-3	J24	3	.216	RG-223/U	50Ω
PL-24	BJ26-3	BJ29-3	J24	3	.216	RG-55A/U	53.5Ω
PL-26	BJ26-4	BJ29-4	J26-4	4	.160	RG-122/U	50Ω
PL-26	BJ26-4	BJ29-4	J26-4	4	.160	RG-195/U	95Ω
PL-26	BJ26-4	BJ29-4	J26-4	4	.160	Essex 21-597	75Ω
PL-26	BJ26-4	BJ29-4	J26-4	4	.160	Essex 421-111	95Ω
PL-26	BJ26-4	BJ29-4	J26-4	4	.160	Belden 8218	75Ω
PL-25	BJ26-5	BJ29-5	J25	5	.100	RG-174/U	50Ω
PL-29	—	—	—	6	.304	Western Electric 724	75Ω
PL-29	—	—	—	6	.304	Western Electric 728	75Ω
PL-29	—	—	—	6	.304	Belden 8281	75Ω
PL-29	—	—	—	6	.304	Brand Rex-T-378	75Ω

See page 38 for teflon jacketed cable tables and page 22 for rigid coax connectors.
NOTE: Cable sizes were developed from manufacturers' data and are not guaranteed.

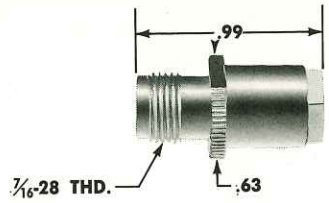
COAXIAL CONNECTORS

TYPE TNC PLUG



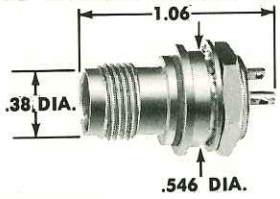
PART NO. PL43 THRU PL49 (see table below)

TYPE TNC STRAIGHT CABLE JACK



PART NO. J43 THRU J49 SERIES
(see table below)

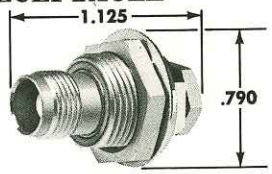
TYPE TNC RECEPTACLE INSULATED



PART NO. BJ47
(with shield solderlug)

Max. panel thickness .375

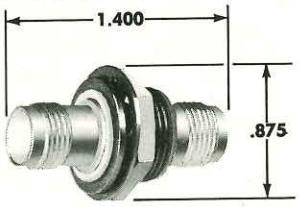
TYPE TNC RECEPTACLE



PART NO. BJ46
(insulated cable input receptacle)

Max. panel thickness .300 See table for — number.
Non-insulated type BJ49 — Cable Group.

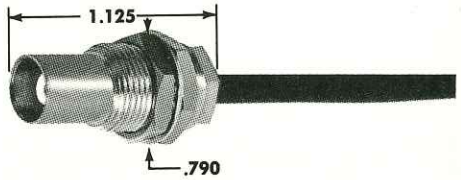
TYPE TNC FEEDTHRU INSULATED



PART NO. BJ48
(double ended feedthru, insulated from chassis)

Max. panel thickness .300

TYPE BNC/TNC RECEPTACLE



PART NO. BJ21
Usable with BNC or TNC type plugs and has the push on lock feature.

See page 17 for assembly instructions.

Max. panel thickness .300 Select cable — number.

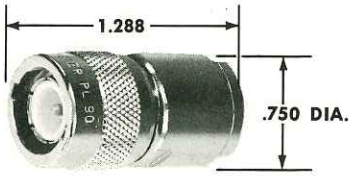
CONNECTOR — PART NUMBERS				CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-48	BJ46-1	BJ49-1	J48	1	.195	RG-58/U	50Ω
PL-48	BJ46-1	BJ49-1	J48	1	.195	Essex 621-715	75Ω
PL-48	BJ46-1	BJ49-1	J48	1	.195	Essex 21-537	50Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	RG-59/U	75Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	RG-62/U	93Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	RG-71/U	93Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	Belden 8211	80Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	Belden 8212	75Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	Belden 8217	80Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	Essex 621-186	75Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	Essex 21-959	73Ω
PL-49	BJ46-2	BJ49-2	J49	2	.242	Essex 21-541	73Ω
PL-49	BJ46-2	BJ49-2	J49	2A	.220	Belden 8279	75Ω
PL-49	BJ46-2	BJ49-2	J49	2A	.220	RG-55/RG-55B/U	53Ω
PL-43	BJ46-2B	BJ49-2B	J43	2B	.250	Western Electric 730A	75Ω

CONNECTOR — PART NUMBERS				CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-47	BJ46-3	BJ49-3	J47	3	.216	RG-223/U	50Ω
PL-47	BJ46-3	BJ49-3	J47	3	.216	RG-55A/U	53.5Ω
PL-46	BJ46-4	BJ49-4	J46	4	.160	RG-122/U	50Ω
PL-46	BJ46-4	BJ49-4	J46	4	.160	RG-195/U	95Ω
PL-46	BJ46-4	BJ49-4	J46	4	.160	Essex 21-597	75Ω
PL-46	BJ46-4	BJ49-4	J46	4	.160	Essex 421-111	95Ω
PL-46	BJ46-4	BJ49-4	J46	4	.160	Belden 8213	75Ω
PL-45	—	—	—	5	.100	RG-174/U	50Ω
PL-44	—	—	—	6	.304	Western Electric 724	75Ω
PL-44	—	—	—	6	.304	Western Electric 728	75Ω
PL-44	—	—	—	6	.304	Belden 8281	75Ω
PL-44	—	—	—	6	.304	Brand Rex-T-378	75Ω

See page 38 Teflon jacketed cable tables and page 22 for rigid coax connectors.
NOTE: Cable sizes were developed from manufacturers' data and are not guaranteed.

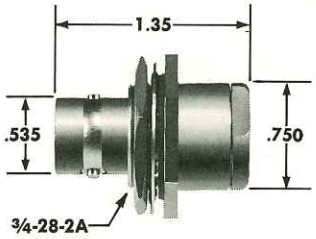
TYPE N & C PLUGS and RECEPTACLES (COAXIAL)

TYPE C PLUG



PART NO. PL-90

TYPE C RECEPTACLES

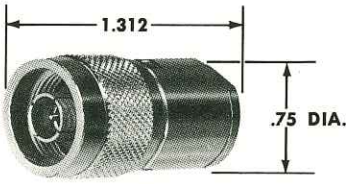


PART NO.
BJ-90
Panel Thickness .187

PART NO.
J-90

(See table below)

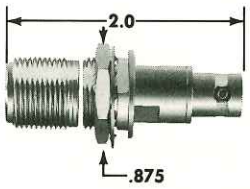
TYPE N PLUG



PART NO. PL-95

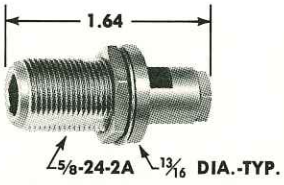
TYPE N RECEPTACLES

CABLE ENTRY FEMALE, INSULATED
1005-0185
(cable groups 1 thru 5)
Panel Thickness .187



INSULATED FEMALE N TO FEMALE BNC
1005-0186
Panel Thickness .187

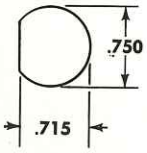
PART NO.
BJ-95
Panel Thickness .312



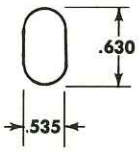
PART NO.
BJ-97 FEMALE N
(cable entry groups 1 thru 5)
Panel Thickness .187

PANEL MOUNTING HOLES

TYPE C



TYPE N



Panel cut out applicable to type C & N receptacles.

CONNECTOR — PART NUMBERS					CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-8, 8A	52Ω
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-11, 11A	75Ω
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-63	88Ω
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-63B	84Ω
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-114 114A	87Ω
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-149	75Ω

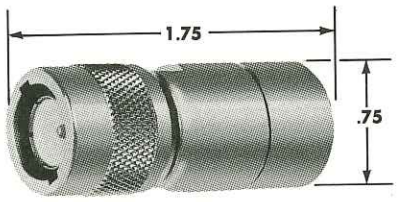
CONNECTOR — PART NUMBERS					CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-90	BJ-90	PL-95	BJ-95	PL-94	6A	.405	RG-213	50Ω
PL-91	BJ-91	PL-96	BJ-96	PL-94	6B	.420/.425	RG-9, 9A	51Ω
PL-91	BJ-91	PL-96	BJ-96	PL-94	6B	.420/.425	RG-9B	50Ω
PL-91	BJ-91	PL-96	BJ-96	PL-94	6B	.420/.425	RG-13, 13A	74Ω
PL-91	BJ-91	PL-96	BJ-96	PL-94	6B	.420/.425	RG-214	50Ω
PL-91	BJ-91	PL-96	BJ-96	PL-94	6B	.420/.425	RG-216	75Ω

NOTE: Add cable group designation 6A or 6B to connector part number i.e. PL-90-6A

N & C ADAPTERS and TERMINATIONS (COAXIAL)

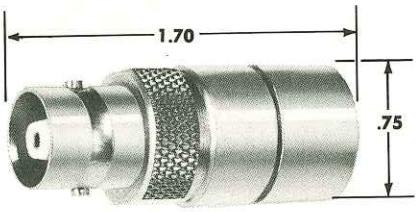
The items shown are built to customer requirements and detailed engineering information is necessary prior to construction.

PL-90 TERMINATED



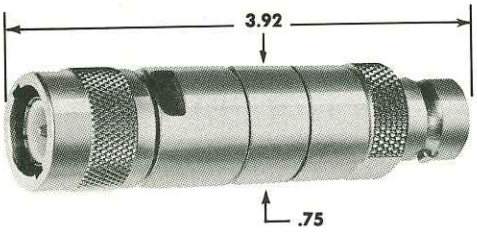
PL-96 TERMINATED

FEMALE C TERMINATED



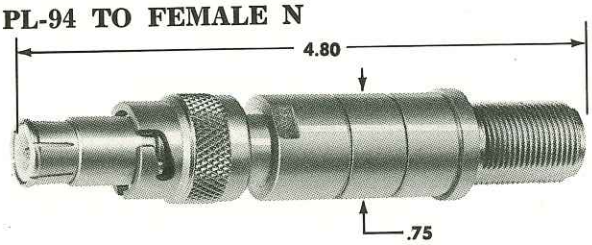
FEMALE N TERMINATED

C MALE TO C FEMALE

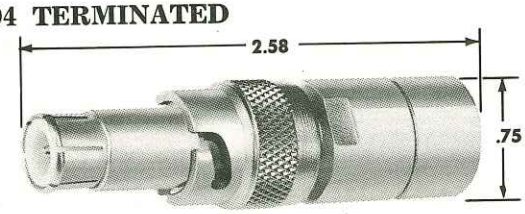


MALE N TO FEMALE N

PL-94 TO FEMALE N



PL-94 TERMINATED



COAXIAL CONNECTORS—SEMI RIGID CABLE

BNC (NON-JACKETED CABLE)

PART NO.
PL-20-* (Plug)
BJ-20-* (Bulkhead jack)
BJI-20-* (Bulkhead jack, insulated)
CJ-20-* (Cable input jack)

For cable diameters: .034, .070, .085, .141, .215, .250.
* Indicate cable diameter desired.
Example: PL-20-.215

TNC (NON-JACKETED CABLE)

PART NO.
PL-40-* (Plug)
BJ-40-* (Bulkhead jack)
BJI-40-* (Bulkhead jack, insulated)
CJ-40-* (Cable input jack)

For cable diameters: .034, .070, .085, .141, .215, .250.
* Indicate cable diameter desired.
Example: PL-40-.070

BNC (JACKETED CABLE)

PART NO.
PL-20 (Plug)
BJ-20 (Bulkhead jack)
BJI-20 (Bulkhead jack, insulated)
CJ-20 (Cable input jack)

.250 cable diameter only

SMA

PART NO.
PL-60-* (Plug)
BJ-60-* (Bulkhead jack)
BJI-60-* (Bulkhead jack, insulated)
CJ-60-* (Cable input jack)

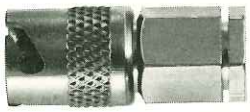
For cable diameters: .034, .070, .085, .141.
* Indicate cable diameter desired.
Example: PL-60-.085

CABLE ENTRY PATCH JACK

PART NO.
J3E-*
J3EW-*

For cable diameters: .141, .215, .250.
* Indicate cable diameter desired.
Example: J3E-.215

TPS



PART NO.
PL-55-* (Plug)
BJ-55-* (Bulkhead jack)
BJI-55-* (Bulkhead jack, insulated)
CJ-55-* (Cable input jack)

For cable diameters: .034, .070, .085, .141, .215.
* Indicate cable diameter desired.
Example: PL-55-.085

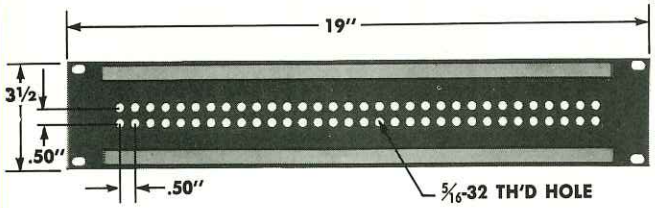
MINIATURE PATCH PANELS

Trompeter-designed patch panels that accept the miniature J8 or J8D jacks are used where high density patching per square inch is required. The J8 jack accepts the TPS male connector and is principally 50 ohms. However, other cable impedances can be used as required. Panels are standard 19" wide. Non-insulated metal panels have open notch and insulated panels have closed oval notch.

HOW TO ORDER MINIATURE PANELS WITH JACKS

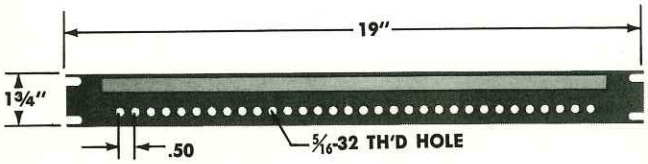
JS — 32 / J8

- **JS** aluminum panel (common ground)
- **JSI** insulated panel
- **32** — Number of jack holes
- **J8** — Type of jack



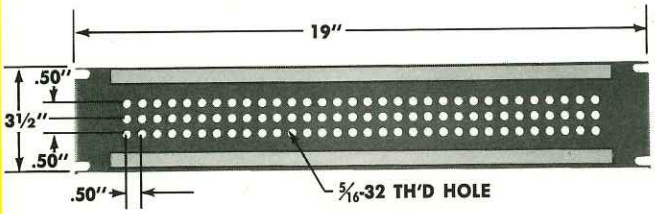
JS-64L
JSI-64L

64 jacks on 3½" metal panel 3/16" thick
(same, insulated panel)



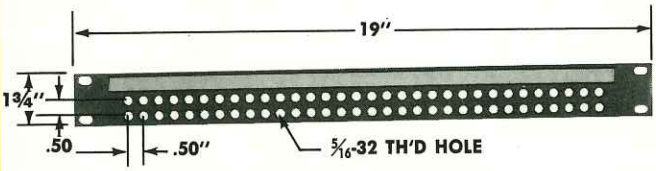
JS-32
JSI-32

32 jacks 1¾" metal panel 3/16" thick
(same, insulated panel)



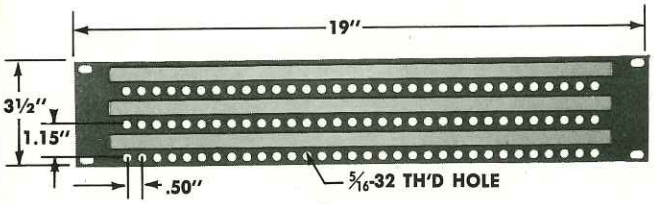
JS-96A
JSI-96A

96 jacks on 3½" metal panel 3/16" thick
(same, insulated panel)



JS-64S
JSI-64S

64 jacks 1¾" metal panel 3/16" thick
(same, insulated panel)

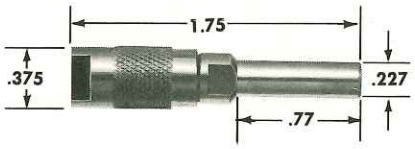


JS-96B
JSI-96B

96 jacks on 3½" metal panel 3/16" thick
(same, insulated panel)

MINIATURE PATCH PLUGS AND JACKS (COAXIAL)

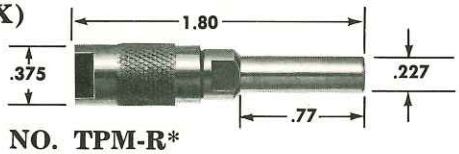
MINIATURE PATCH PLUG (COAX)



PART NO. PL-3

For cables: RG-122/U 50 ohm, AMPHENOL 21-597 or BELDEN 8218 (75 ohm) Cable group 4.

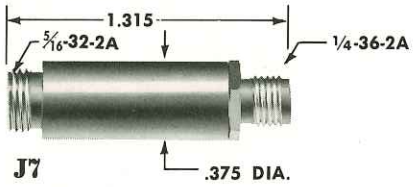
MINIATURE TERMINATION PLUG (COAX)



PART NO. TPM-R*

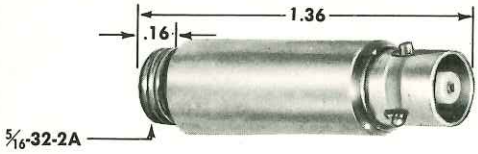
* Substitute resistance value in place of "R"; i.e., TPM-75.

MINIATURE PANEL JACK WITH SMA FEMALE (COAX)



PART NO. J7

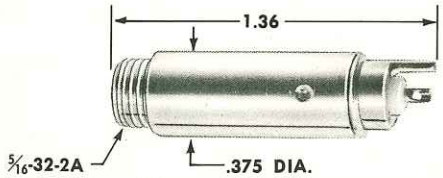
MINIATURE PANEL JACKS (COAX)



PART NO. J8

Input cable terminated in "TPS" plug.

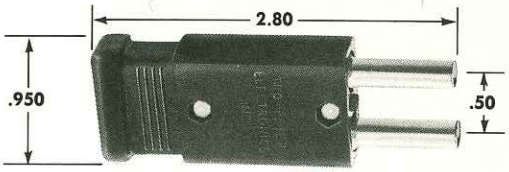
MINIATURE PANEL JACKS (COAX)



PART NO. J8D

Input cable terminated directly to solder lugs on jack.

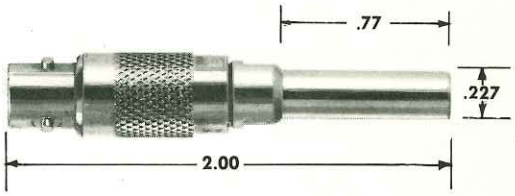
MINIATURE LOOPING PLUG (COAX)



PART NO. LPM-(50, 75, 93)

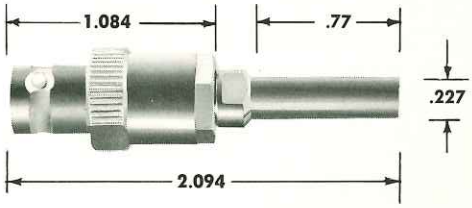
COLOR CODED HANDLE
50Ω green, 75Ω violet, 93Ω white.

MINIATURE PATCH PLUG TO TPS ADAPTER



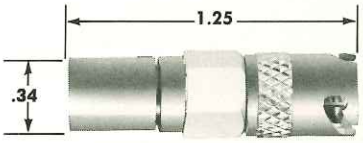
PART NO. ADM-1

MINIATURE PATCH PLUG TO BNC ADAPTER



PART NO. ADM-2

TPS TERMINATION

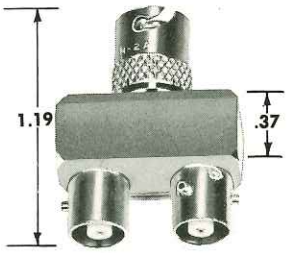


TNAM-1-R*

* Substitute resistance value in place of "R"; i.e., TNAM-1-75.

MINIATURE PATCH CORDS AND NETWORKS (COAXIAL)

PART NO. PNM-2A
1 JACK, TWO INPUTS



FIXED PARALLELING TPS input, J8 jacks only

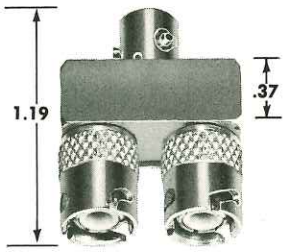
MINIATURE CABLE ASSEMBLIES (COAX)

Part No.
PCMY — L — Z

Miniature plugs
Lengths in inches
50, 75, 93Ω

Standard length is 6, 12, 18, 24 and 36 inches.

PART NO. PNM-2
2 JACKS, ONE INPUT



FIXED PARALLELING TPS input, J8 jacks only

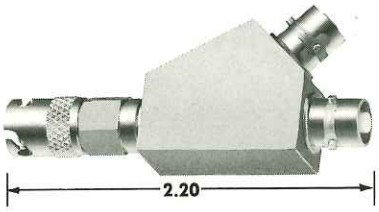
MINIATURE CABLE ASSEMBLIES (COAX)

Part No.
PCMX — L — Z

Miniature Plugs
Length in inches
50, 75, 93 ohm

Standard length is 6, 12, 18, 24, and 36 inches.

PART NO. PNM-2C
1 JACK, TWO INPUTS



FIXED PARALLELING TPS input, J8 jacks only

MINIATURE CABLE ASSEMBLIES (COAX)

Part No.
PCRX — L — Z

SMA Plug and
PL-3 Patch Plug
Length in inches
Impedance

Standard length is 6, 12, 18, 24, and 36 inches.

MINIATURE PATCH CORDS (COAX)

Part No.
PCM — L — Z

Miniature plugs PL-3
Length in inches
50, 75, 93Ω

Standard length is 6, 12, 18, 24 and 36 inches.

MINIATURE CABLE ASSEMBLIES (COAX)

Part No.
PCRY — L — Z

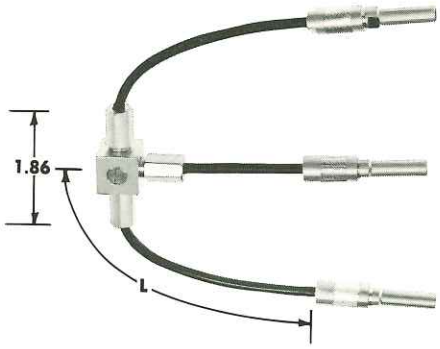
SMA Plugs
Length in inches
Impedance

Standard length is 6, 12, 18, 24, and 36 inches.

MINIATURE PATCH CORDS AND NETWORKS (COAXIAL)

MINIATURE TRIPLE PARALLEL (COAX) PATCH CORDS

The triple parallel patch cord, PCSM, is used where three coax cables in parallel will not cause a serious mismatch in impedance. The PCSM is not recommended for R.F. signals.



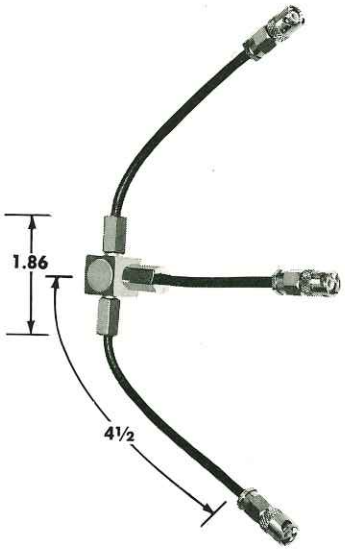
Part No.
PCSM — L — Z

Lengths in inches

50, 75, or 93Ω

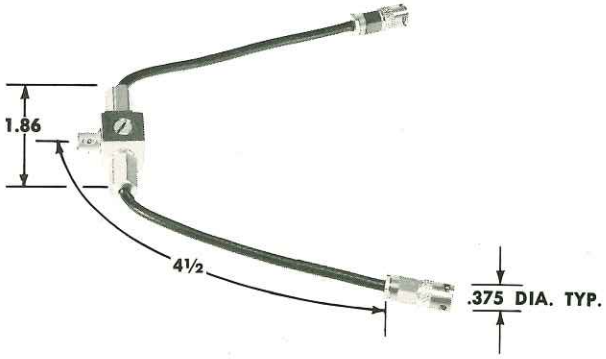
Standard length is 9 inches.

3 JACKS, NO INPUT PNM-3-(50, 75, 93)



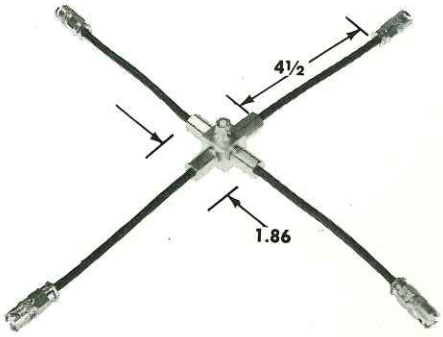
RANDOM PARALELING No input, J8 jacks only

2 JACKS, ONE INPUT PNM-2B-(50, 75, 93)



RANDOM PARALLELING TPS input, J8 jacks only

4 JACKS, ONE INPUT PNM-4-(50, 75, 93)



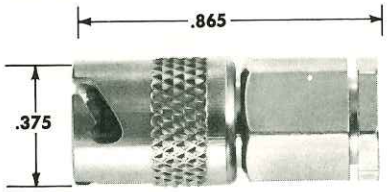
RANDOM PARALLELING TPS input, J8 jacks only

MINIATURE COAXIAL CONNECTORS—UNICUT DESIGN

TPS CONNECTORS

The TPS connectors are sub-miniature connectors that were designed for lightweight high density applications. This design incorporates a three-lug bayonet coupling for quick mating and the elimination of the rocking effect that is encountered in the two-lug series. As in all Trompeter designs, the assembly is the same as those connectors on page 17.

TPS PLUG

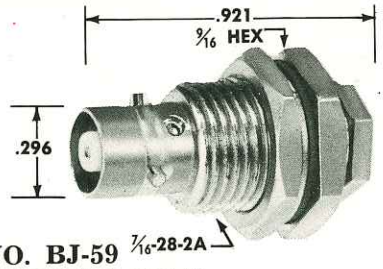


PL-50 THRU PL-54 (See table)

TPS CONNECTORS/CABLE

CONNECTOR — PART NUMBERS				CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-52	BJ-59-1	J-51-1	BJI-51-1	1	.195	RG-58/U	50Ω
PL-52	BJ-59-1	J-51-1	BJI-51-1	1	.195	Essex 621-715	75Ω
PL-52	BJ-59-1	J-51-1	BJI-51-1	1	.195	Essex 21-537	50Ω
PL-53	—	—	—	2	.242	RG-59/U	75Ω
PL-53	—	—	—	2	.242	RG-59/U	75Ω
PL-53	—	—	—	2	.242	RG-62/U	93Ω
PL-53	—	—	—	2	.242	RG-71/U	93Ω
PL-53	—	—	—	2	.242	Belden 8211	80Ω
PL-53	—	—	—	2	.242	Belden 8212	75Ω
PL-53	—	—	—	2	.242	Belden 8217	80Ω
PL-53	—	—	—	2	.242	Essex 621-186	75Ω
PL-53	—	—	—	2	.242	Essex 21-959	73Ω
PL-53	—	—	—	2	.242	Essex 21-541	73Ω
PL-54	BJ-59-3	J-51-3	BJI-51-3	3	.216	RG-223/U	50Ω
PL-54	BJ-59-3	J-51-3	BJI-51-3	3	.216	RG-55A/U	53.5Ω
PL-51	BJ-59-4	J-51-5	BJI-51-4	4	.160	RG-122/U	50Ω
PL-51	BJ-59-4	J-51-5	BJI-51-4	4	.160	RG-195/U	95Ω
PL-51	BJ-59-4	J-51-5	BJI-51-4	4	.160	Essex 21-597	75Ω
PL-51	BJ-59-4	J-51-5	BJI-51-4	4	.160	Essex 421-111	95Ω
PL-51	BJ-59-4	J-51-5	BJI-51-4	4	.160	Belden 8218	75Ω
PL-50	BJ-59-5	J-51-5	BJI-51-5	5	.100	RG-174/U	50Ω

TPS RECEPTACLE



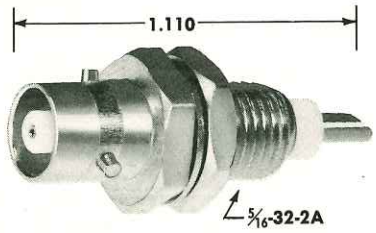
PART NO. BJ-59
(Cable Group 1, 3, 4, and 5)
NOTE:
BJI-59 (insulated) available on special order.

MINIATURE BAYONET CONNECTORS

The Miniature Bayonet Connector series are a non-constant impedance subminiature connector with bayonet lock coupling for fast connect and disconnect.

Plug connectors in this series have female type contacts and jacks have male contacts. Assembly is the same as the BNC series on page 17 that are reusable and require no special tools for assembly.

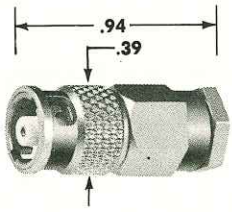
TPS RECEPTACLE



PART NO. BJ-57

NOTE:
BJI-57 (insulated) available on special order.

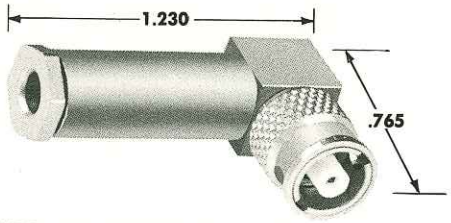
MB PLUG



PART NO. PL-110 (See table Page 28)
(Cable groups 1, 4, and 5)

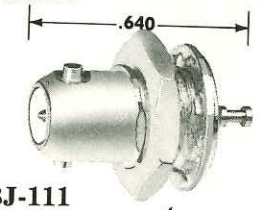
MINIATURE COAXIAL CONNECTORS

MB PLUG



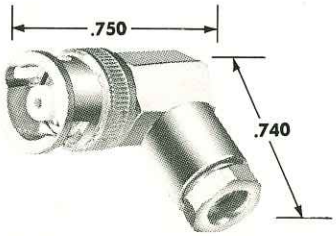
PART NO. PL-111-L (See table below)

MB RECEPTACLE



PART NO. BJ-111
Max. panel thickness 3/32"

MB PLUG



PART NO. PL-111S (See table below)

MB TERMINATION

PART NO. TP-110-R*
* Substitute resistance in place of "R", i.e., TP-110-75.

MB RECEPTACLE

PART NO. BJ-110
Max. panel thickness 1/8"

SMA CONNECTORS

The Trompeter SMA connectors feature quick assembly without special tools and can be disassembled and reused without new or replacement parts. In addition to standard SMA connectors, insulated versions are also available that isolate the shield from the mounting hardware and ground to prevent unwanted ground loops and common mode returns. (Refer to Noise Paper, pages 1 thru 8 inclusive). They are made of lightweight, gold-plated corrosion resistant steel 303 and perform with exacting mechanical integrity.

The subminiature, precision, high-frequency connector gives repeatable electrical performance from DC to 18 GHz and meets the requirements of MIL-C-39012.

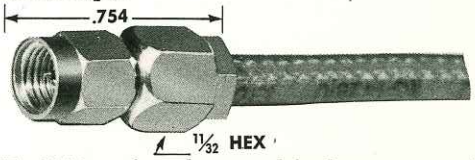
All SMA connectors are reusable and are assembled the same as the BNC types (page 17).

MB CONNECTORS/CABLES

CONNECTOR — PART NUMBERS			CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-110-1	PL-111S-1	PL-111L-1	1	.195	RG-58/U	50Ω
PL-110-1	PL-111S-1	PL-111L-1	1	.195	Essex 621-715	75Ω
PL-110-1	PL-111S-1	PL-111L-1	1	.195	Essex 21-537	50Ω
PL-110-4	PL-111S-4	PL-111L-4	4	.160	RG-122/U	50Ω
PL-110-4	PL-111S-4	PL-111L-4	4	.160	RG-195/U	95Ω
PL-110-4	PL-111S-4	PL-111L-4	4	.160	Essex 21-597	95Ω
PL-110-4	PL-111S-4	PL-111L-4	4	.160	Essex 421-111	95Ω
PL-110-4	PL-111S-4	PL-111L-4	4	.160	Belden 8218	75Ω
PL-110-5	PL-111S-5	PL-111L-5	5	.100	RG-174/U	50Ω

SMA PLUG

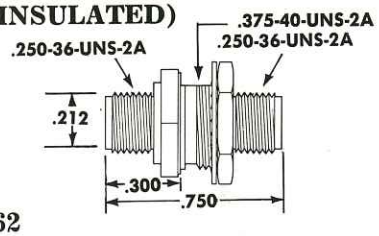
PART NO. PL-60
(Cable Group).



NOTE: SMA series plugs and jacks are assembled the same as on Page 17. (See table Page 29).

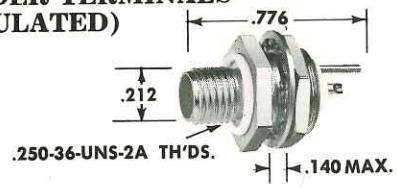
MINIATURE COAXIAL CONNECTORS

SMA DOUBLE ENDED FEED THRU RECEPTACLE (INSULATED)



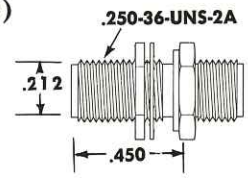
PART NO. BJI-62
Panel thickness .140 max.

SMA BULKHEAD RECEPTACLE SOLDER TERMINALS (INSULATED)



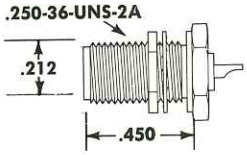
PART NO. BJI-61
Panel thickness .140 max.

SMA DOUBLE ENDED FEED THRU (NON-INSULATED)



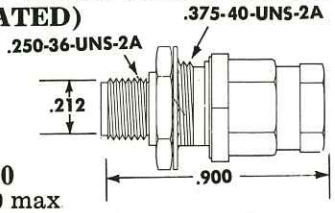
PART NO. BJ-62
Panel thickness .140 max.

SMA BULKHEAD RECEPTACLE SOLDER TERMINALS (NON-INSULATED)



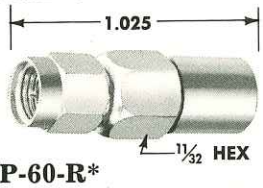
PART NO. BJ-61
Panel thickness .140 max.

SMA BULKHEAD RECEPTACLE CABLE ENTRY (INSULATED)



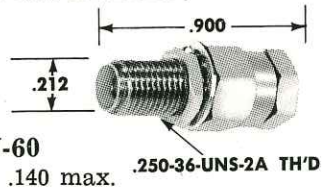
PART NO. BJI-60
Panel thickness .140 max

SMA TERMINATION PLUG



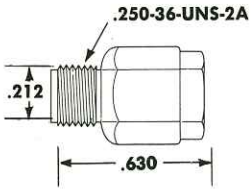
PART NO. TP-60-R*
*Substitute resistance in place of "R"; i.e., TP-60-75.

SMA BULKHEAD RECEPTACLE CABLE ENTRY (NON-INSULATED)



PART NO. BJ-60
Panel thickness .140 max.

SMA CABLE JACK



PART NO. CJ-60

SMA COAXIAL CABLE GROUPS

CONNECTOR — PART NUMBERS				CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-60-1	CJ-60-1	BJ-60-1	BJI-60-1	1	.195	RG-58/U	50Ω
PL-60-1	CJ-60-1	BJ-60-1	BJI-60-1	1	.195	Essex 621-715	75Ω
PL-60-1	CJ-60-1	BJ-60-1	BJI-60-1	1	.195	Essex 21-537	50Ω
PL-60-4	CJ-60-4	BJ-60-4	BJI-60-4	4	.160	RG-122/U	50Ω
PL-60-4	CJ-60-4	BJ-60-4	BJI-60-4	4	.160	RG-195/U	95Ω
PL-60-4	CJ-60-4	BJ-60-4	BJI-60-4	4	.160	Essex 21-597	75Ω
PL-60-4	CJ-60-4	BJ-60-4	BJI-60-4	4	.160	Essex 421-111	95Ω
PL-60-4	CJ-60-4	BJ-60-4	BJI-60-4	4	.160	Belden 8218	75Ω
PL-60-5	CJ-60-5	BJ-60-5	BJI-60-5	5	.100	RG-174/U	50Ω

NOTE: Other cable sizes may be accommodated on special order. See Page 38 for table on teflon jacketed cable.

WESTERN ELECTRIC TYPE MINIATURE 75 OHM JACKS

WESTERN ELECTRIC TYPE MINIATURE PANELS

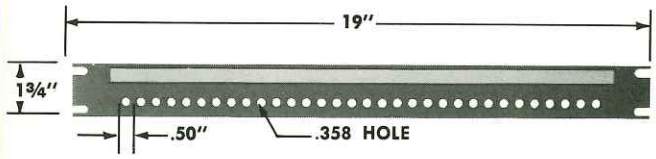
The Western Electric **miniature** patch panel jacks and plugs were designed for low VSWR 75 ohm coaxial applications used in microwave sub-carrier telephone systems. The Trompeter-designed J-12 jack and PL-11 plug combination have a VSWR of 1.04:1 in the 60-80 MHz range. They are interchangeable with the WE 560 jacks. Metal panels have open notch and insulated panels have oval notch. These panels and jacks are not interchangeable with those shown on page 23.

HOW TO ORDER

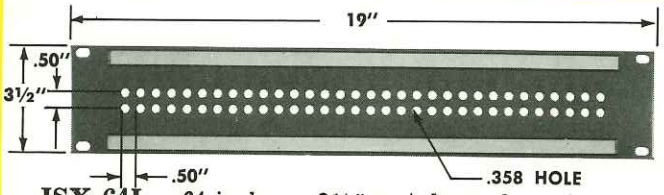
JSX aluminum panel (common ground)
JSIX insulated panel

Part No.
JSX — 32 / J12

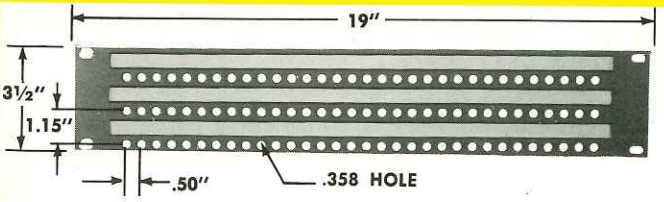
- J12: Type of jack
- 32: Number of jack holes



JSX-32 32 jacks 1¾" metal panel 5/16" thick
JSIX-32 (same, insulated panel)

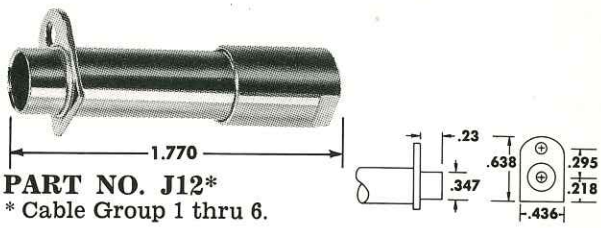


JSX-64L 64 jacks on 3½" metal panel 5/16" thick
JSIX-64L (same, insulated panel)
JSX-64S 64 jacks on 1¾" metal panel 5/16" thick, one identification strip.
JSIX-64S (same, insulated panel)



JSX-96B 96 jacks on 3½" metal panel 5/16" thick
JSXI-96B (same, insulated panel)

W.E.-TYPE MINIATURE JACK



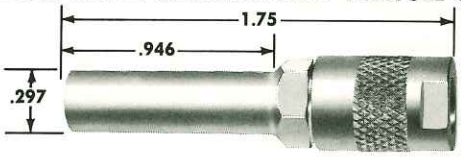
PART NO. J12*
* Cable Group 1 thru 6.

NOTE: Similar to Western Electric Miniature Coax Jack 560A using UNICUT assembly method.

W.E.-TYPE MINIATURE PATCH CORDS

PCMW-L-75 Standard length 6, 12, 18, 24, 36 inches
IMPEDANCE: 75Ω

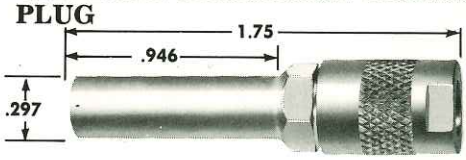
W.E.-TYPE MINIATURE PATCH PLUG



PART NO. PL-11—Cable Group

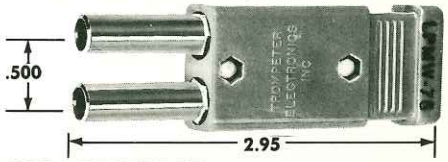
NOTE: Similar to Western Electric plug 440A with UNICUT design for use with cable groups 1 thru 5.

W.E.-TYPE MINIATURE TERMINATION PLUG



PART NO. TPMW-R*
* Substitute resistance value in place of "R"; i.e., TPMW-75.

W.E.-TYPE MINIATURE LOOPING PLUG



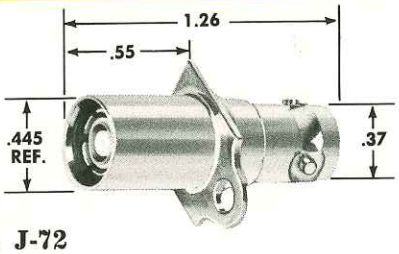
PART NO. LPMW-75
COLOR CODED HANDLE 75Ω violet

TWINAX/TRIAX CONCENTRIC JACKS AND PLUGS

Twinax and triax patching was designed to provide easy, quick connect and disconnect capability using twinax and triax cables. The design is also for use where "Noise Free Guarded Systems" are required.

Twinax and Triax connectors illustrated below do not require mechanical alignment for mating and are available for cables of different sizes manufactured by other companies. All twinax/triax patch jacks will fit the standard patch panels shown on pages 9 and 10. Our engineering staff is always available to help you determine your patching requirements.

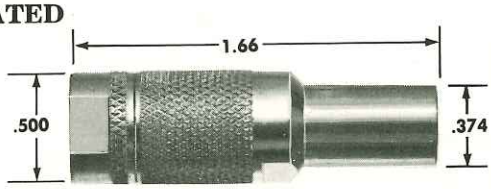
PATCH JACK



PART NO. J-72

Rear mates with Trompeter plugs PL-75, PL-76 and PL-77, PL-78, front end is of concentric circular shield design.

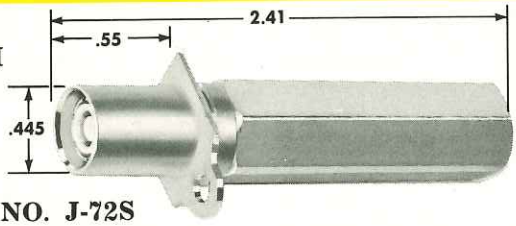
TERMINATED PLUG



PART NO. TPT-R*

Incorporates ¼ watt 2% resistor and provides termination of a circuit from the front of the patch panel.* Substitute resistance value for R.

PATCH JACK



PART NO. J-72S

Cable assembles directly to rear solder lugs of jack. A metal hood is provided for RFI shielding, and a nylon bushing provides locking for the cable.

TWINAX PATCH PLUG

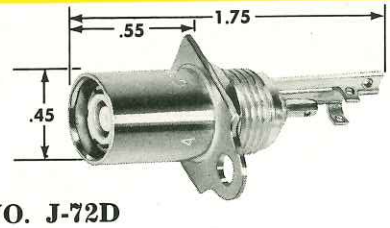
PART NO. PL-71

Trompeter Twinax cable available in 78Ω or 124Ω.

PART NO. PL-72

Trompeter Triax cable available in 50Ω or 75Ω.

PATCH JACK

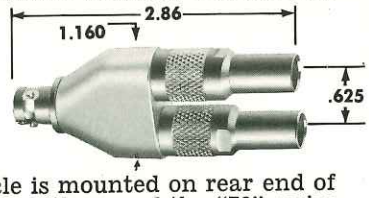


PART NO. J-72D

Same as J-72S without metal hood.

The above jacks mount in patch panels shown on pages 9 and 10.

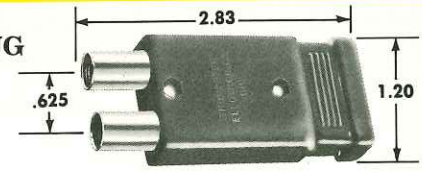
LOOPING PLUG WITH CABLE ADAPTER



PART NO.
LPTWA-Z
LPTRA-Z

BJ-77 female receptacle is mounted on rear end of looping plug and mates with any of the "70" series twinax/triax type plugs. Shield integrity is maintained throughout. Not for use with JSW/JSWI-24 and JSW/JSWI-40 panels.

LOOPING PLUG



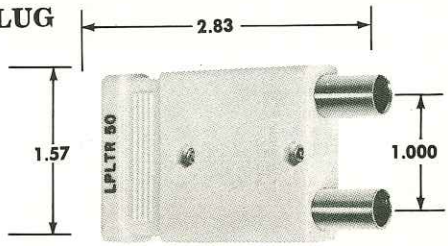
Color Coded Handle
Blue: Twinax
Yellow: Triax

PART NO. LPTW — Z

LPTW Twinax
LPTR Triax

IMPEDANCE:
TWINAX 78, 124
TRIAX 50, 75

LOOPING PLUG



Color Coded Handle
Blue: Twinax
Yellow: Triax

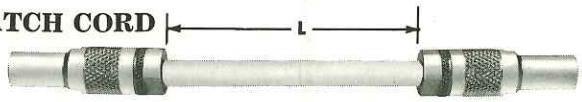
PART NO.
LPLTW-Z
LPLTR-Z

Same as LPTW and LPTR except 1" centers.

TWINAX/TRIAX CONCENTRIC PATCH CORDS

Standard Patch Cords are 6, 12, 18, 24, and 36 inches long, measured from hub to hub (L). Longer lengths may be ordered by substituting the desired length in the part number.

PATCH CORD



Part No.
PTW — L — Z

PTW Twinax
PTR Triax

LENGTH IN INCHES
TWINAX 78, 124Ω
TRIAX 50, 75Ω

CABLE ASSEMBLY

Part No.
PTWY — L — Z

PTWY-L-Z Twinax
PTRY-L-Z Triax

LENGTH IN INCHES
TWINAX 78, 124Ω
TRIAX 50, 75Ω

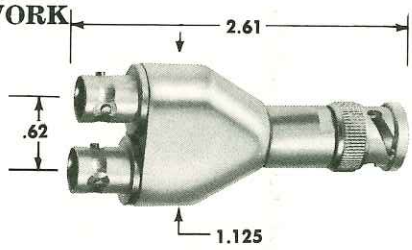
CABLE ASSEMBLY

Part No.
PTRX — L — Z

PTRX-L-Z
PTWX-L-Z

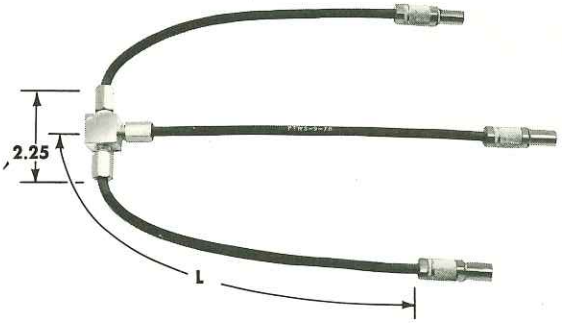
LENGTH IN INCHES
TWINAX 78, 124Ω
TRIAX 50, 75Ω

PARALLEL NETWORK



PART NO.
TN-2A

TWINAX/TRIAX TRIPLE PARALLEL PATCH CORDS

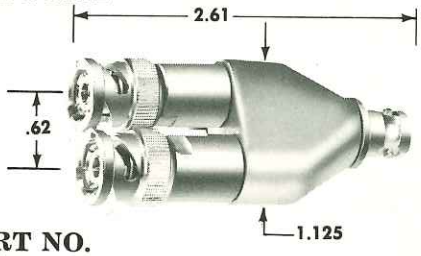


Part No.
PTWS — L — Z

PTWS Twinax
PTRS Triax

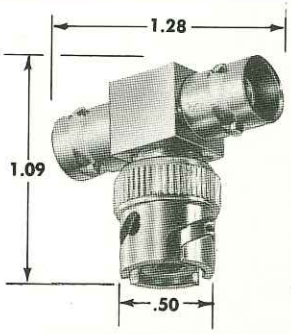
LENGTH IN INCHES
IMPEDANCE:
TWINAX 78, 124Ω **TRIAX** 50, 75Ω
STANDARD LENGTH (L) IS 9 INCHES

PARALLEL NETWORK



PART NO.
TN2

TEE

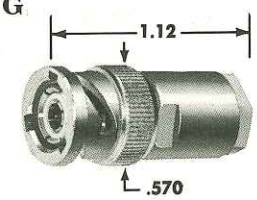


PART NO.
BN-73

2 females, 1 male, concentric Triax/Twinax

TWINAX/TRIAX CONCENTRIC PLUGS and RECEPTACLES

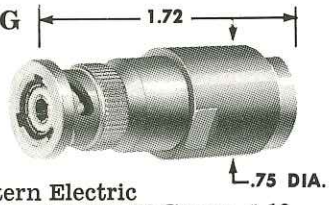
CABLE PLUG



PART NO.
PL-75 ¼" Twinax only or Cable Group #9
PL-76 ¼" Triax or Cable Group #7

Mates with panel jack J-72 and receptacles BJ-77, BJ-78, BJ-79, BJ-72, 73 and 74.
Connectors available for additional cable groups.

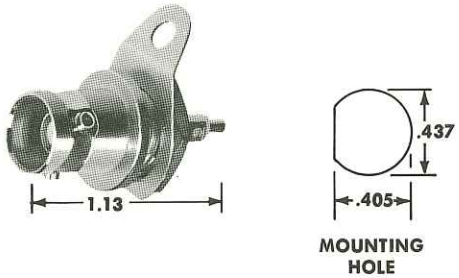
CABLE PLUG



PART NO.
PL-77 Western Electric 754E and RG22/U Group # 10
PL-78 Western Electric Group #11 760A Twinax cable

Mates with panel jack J-72 and receptacles BJ-77, BJ-78, BJ-79, BJ-72, 73 and 74.
Connectors available for additional cable groups.

BULKHEAD JACK

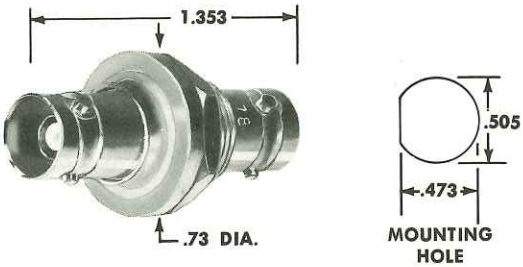


PART NO. BJ-77
Panel thickness .275 max.

BULKHEAD JACK INSULATED

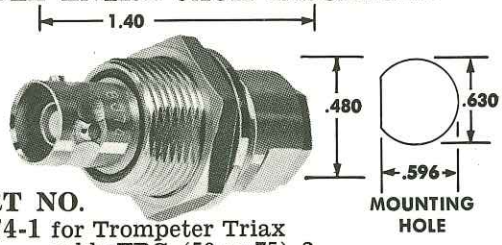
PART NO. BJ-72
Outer circuit insulated from chassis
Panel thickness .250

BULKHEAD MOUNTED FEED THRU



PART NO. BJ-78
Panel thickness .300 max.

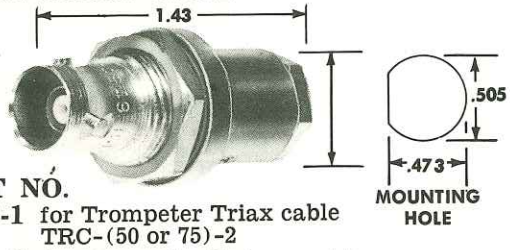
CABLE ENTRY JACK INSULATED



PART NO.
BJ-74-1 for Trompeter Triax cable TRC-(50 or 75)-2
BJ-74-2 for Trompeter Twinax cable TWC-(78 or 124)-2

Outer circuit insulated from chassis.
Panel thickness .430 max.

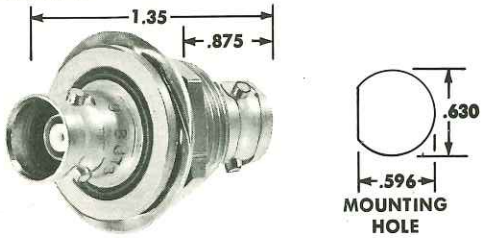
CABLE ENTRY JACK



PART NO.
BJ-79-1 for Trompeter Triax cable TRC-(50 or 75)-2
BJ-79-2 for Trompeter Twinax cable TWC-(78 or 124)-2

Panel thickness .250 max.
Connectors available for additional cable groups.

BULKHEAD MOUNTED FEED THRU INSULATED



PART NO. BJ-73
Outer circuit insulated from chassis
Panel thickness .425 max.

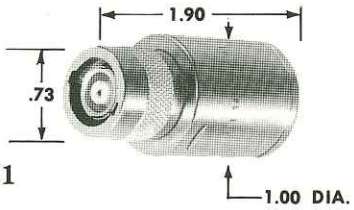
"C" TYPE CONCENTRIC TWINAX/TRIAX CONNECTORS

C TYPE CONCENTRIC CONNECTORS

Trompeter designed "C" type concentric connectors are for use with the larger twinax or triax cables from .25" to .615" O.D. Each cable jack (CJ) will mate with each plug (PL) regardless of cable group.

The "C" type triax/twinax connectors function the same as the 70 series illustrated on pages 31 to 33 and feature the unicut type of assembly, requiring no special tools.

C PLUG

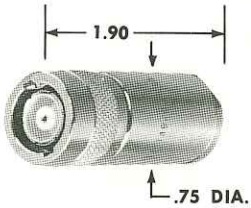


PART NO. PL-81

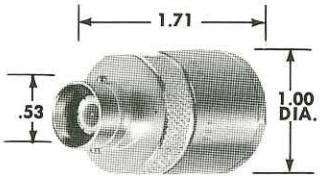
CABLE GROUP 16

C PLUG

PART NO.	CABLE GROUP
PL-82	12
PL-83	10
PL-84	9
PL-85	11
PL-86	14
PL-87	13
PL-88	15



C JACK

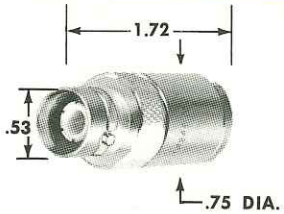


PART NO. CJ-81

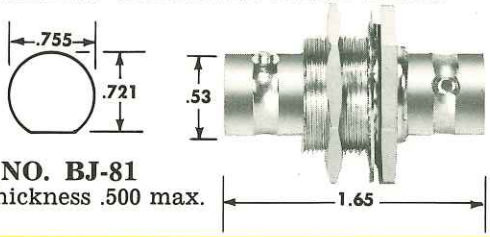
CABLE GROUP 16

C RECEPTACLE

PART NO	CABLE GROUP
CJ-82	12
CJ-83	10
CJ-84	9
CJ-85	11
CJ-86	14
CJ-87	13
CJ-88	15

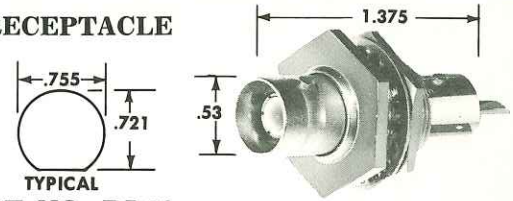


C BULKHEAD MOUNTED FEED THRU



PART NO. BJ-81
Panel thickness .500 max.

C RECEPTACLE

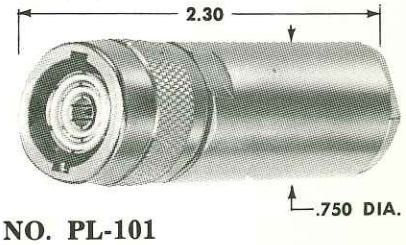


PART NO. BJ-80
Panel thickness .500 max.

QUADRAX CONNECTORS

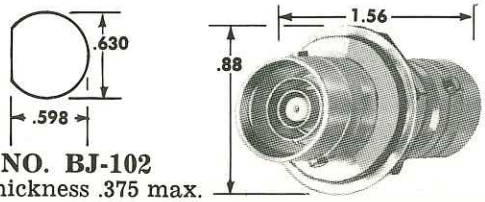
Quadrax connectors were designed for the ultimate in protected and guarded circuit applications. Quadrax cable is a signal cable that has a balanced twisted signal pair of wires with two separate and insulated braids (refer to Noise in Cable Systems, pages 1 thru 8). The connectors shown are concentric in design and do not require mechanical alignment for mating. They accept Trompeter Quadrax Cable Type QRC-78-2.

CABLE PLUG



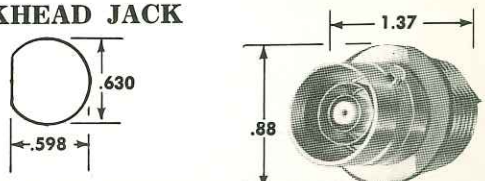
PART NO. PL-101

BULKHEAD MOUNTED FEED THRU



PART NO. BJ-102
Panel thickness .375 max.

BULKHEAD JACK



PART NO. BJ-101
Panel thickness .375 max.

TWINAX/TRIAX/QUADRAX CABLE GROUPS

CONNECTOR — PART NUMBERS						CABLE GROUP	DIA.	CABLE	NOM. IMP.
PL-72	J-72-S	PL-76	BJ-74-1	—	BJ-79-1	7	.242	Trompeter TRC-50-2	50Ω
PL-72	J-72-S	PL-76	BJ-74-1	—	BJ-79-1	7	.242	Trompeter TRC-75-2	75Ω
PL-72	J-72-S	PL-76	BJ-74-1	—	BJ-79-1	7	.242	Essex 621-106	72Ω
PL-72	J-72-S	PL-76	BJ-74-1	—	BJ-79-1	7	.242	Times TRF-502	50Ω
PL-72	J-72-S	PL-76	BJ-74-1	—	BJ-79-1	7	.242	Times TRF-752	75Ω
PL-72	J-72-S	PL-76	BJ-74-1	—	BJ-79-1	7	.242	General T43M	124Ω
—	—	—	PL-78-8	—	—	8	.325	Belden 8227	73Ω
PL-84	CJ-84	PL-71	J-72-S	PL-75	BJ-79-2	9	.242	Trompeter TWC-78-2	78Ω
PL-84	CJ-84	PL-71	J-72-S	PL-75	BJ-79-2	9	.242	Trompeter TWC-124-2	124Ω
PL-84	CJ-84	PL-71	J-72-S	PL-75	BJ-79-2	9	.242	RG-108/U	78Ω
PL-84	CJ-84	PL-71	J-72-S	PL-75	BJ-79-2	9	.242	Superior FVP224	124Ω
PL-84	CJ-84	PL-71	J-72-S	PL-75	BJ-79-2	9	.242	Times BL782	78Ω
PL-84	CJ-84	PL-71	J-72-S	PL-75	BJ-79-2	9	.242	Times BL-1242	124Ω
PL-77	PL-83	CJ-83	—	—	—	10	.42	RG-22/U, RG-22B/U	95Ω
PL-77	PL-83	CJ-83	—	—	—	10	.42	W. E. 754E	124Ω
PL-77	PL-83	CJ-83	—	—	—	10	.42	General T43	124Ω
PL-77	PL-83	CJ-83	—	—	—	10	.42	Mohawk 5305-8	124Ω
PL-77	PL-83	CJ-83	—	—	—	10	.42	Superior FVP219	124Ω
PL-85	CJ-85	—	PL-78-11	—	—	11	.308	W. E. 760A	124Ω
PL-82	CJ-82	—	—	—	—	12	.44	W. E. 16 PEVL	124Ω
PL-82	CJ-82	—	—	—	—	12	.44	General V1AL	124Ω
PL-82	CJ-82	—	—	—	—	12	.44	Superior 16 AWG	124Ω
PL-87	CJ-87	—	—	—	—	13	.315	Belden 8232	75Ω
PL-86	CJ-86	—	—	—	—	14	.475	Belden 8233	75Ω
PL-88	CJ-88	—	—	—	—	15	.490	Essex 21-583 RG-8/U	52Ω
PL-81	CJ-81	—	—	—	—	16	.615	Belden 21-950	124Ω
PL-101	—	—	—	—	—	—	.230	QRC-78-2 Trompeter	78Ω

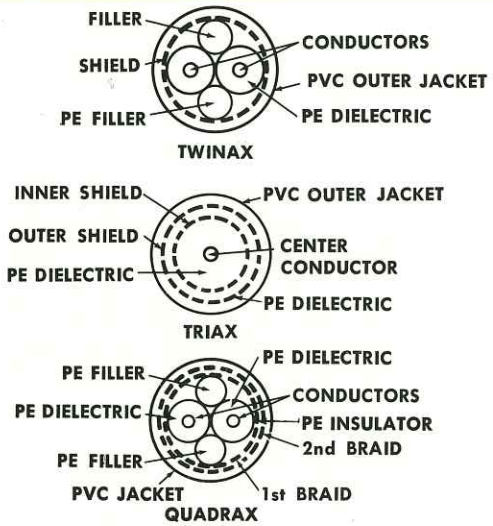
Refer to Pages 33-34 for connector series.

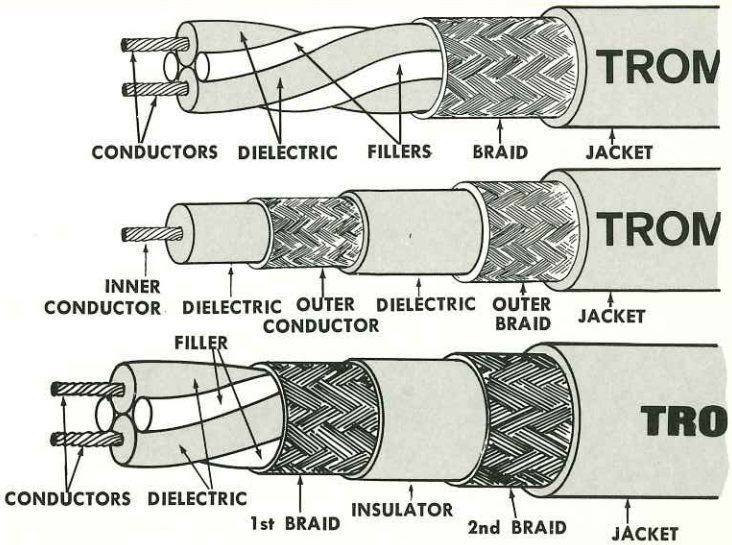
IMPROVED VIDEO AND HIGH FREQUENCY CABLES

Twinax cable is a two-conductor twisted balanced line having a specific impedance, with a shielding braid around both conductors. The balanced twisted signal carrying wires provide cancellation of any random induced noise, voltage pickup or magnetic noise fields that pass through the copper braid. Twinax cable is used extensively in environmental laboratories, analog and digital signal transmission, T.V. video transmission, telephone applications and wherever signal frequencies below 10 MHz are distributed.

Coax cables in low-level signal applications are subject to pickup of noise through ground loop, magnetic fields and capacitive effects. Reduction of noise pickup and improvement of the signal-to-noise ratio can be attained by using "Triax" cable. Briefly, triax cable is coax cable with an additional outer copper braid insulated from signal carrying conductors. This additional braid or shield is grounded and bypasses both ground loop and capacitive field noise currents. The resultant is better signal-to-noise ratio. Triax cable is used where very low-level and high-level R.F. signals are transmitted simultaneously through adjacent cables that are bunched together or in high energy fields from transmitters, radar and other noise generating devices. Concentric connectors for the above cables are illustrated on the preceding pages.

Quadrax cables are similar to twinax cables with the exception that the quadrax contains one additional shield component. The balanced twisted signal pair with two (2) separate insulated braided shields are used for the elimination of noise pickup or whenever the ultimate EMI suppression is required. TEI presently stocks 78 ohms 9/32" O.D. cable and mating connectors. Cable type available is QRC-78-2. Refer to Technical Paper, pages 1 through 8, for quadrax applications.





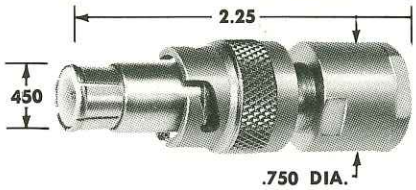
CABLE TYPE	QRC-78-2	TWC-78-2	TWC-124-2	TRC-50-2	TRC-75-2
Impedance	78 ± 2Ω	78Ω	124Ω	50Ω	75Ω
Max. O.D.	.280	.245 ± .005	.245 ± .005	.245 ± .010	.245 ± .010
Shield Max. O.D.	.181	.195	.195	.210	.210
Core O.D.	.158	.162 ± .004	.162 ± .004		
Insulation O.C.	.079	.081 ± .002	.081 ± .002	.116 ± .004	.116 ± .004
Conductor O.D. Tinned Stranded	.038	.039	.022	.037 ± .001	.019 ± .001
Max. Operating Voltage		1 KV	1 KV		
Min. Bend Radius		1¼"	1¼"	1.0"	1.0"
Cap. PF/Ft.	24.5	19.6	12.3	29.5	20
Conductor Loop Res. per M Ft.		17.9	56.8		
1st Jacket/O.D.	.205			.175 ± .005	.175 ± .005
Braid, Max.				.146	.146
Max. Operating Voltage, D.C.				6 KV	6 KV
Max. Operating Voltage, A.C.	2 KV			2 KV	2 KV
Attenuation, dB per 100 feet					
1 MHz		.7	.1		
2 MHz		.94	.2		
4 MHz	1.5 dB	1.4	.5		
6 MHz		1.62	.7		
10 MHz		2.15	1.1	1.10	1.10
50 MHz				3.20	3.20
100 MHz				4.50	4.50
200 MHz				6.50	6.50
500 MHz				10.00	10.00
700 MHz				10.60	10.60
1000 MHz				11.10	11.10

PRECISION PATCHING 50 OHM (COAXIAL)

Communication and telemetry equipment are required to operate at ever higher frequencies in search for spectrum space.

Trompeter Electronics offers low VSWR patching systems with plugs, jacks and accessories to fill that need. The 50 ohm plugs are push-fit as the standard patch plug, and have the added feature of "locking down" in the same manner as a "C" type connector. The rear of the patch jack is fitted with a standard 50 ohm "N" type female. This system may be used where patching of 500 watts or up to 3 GHz and where RG8, 9, 213, 214, or Heliax are used as input cables. Panel is steel ¼" x 3½" x 19"

PATCH PLUG



PART NO. PL-94

PATCH CORD

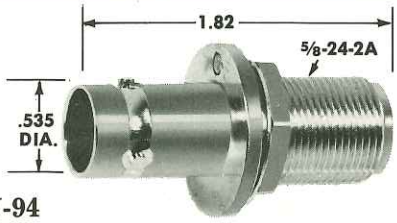
PCH-L-50

Precision Patch Cable

Length

Impedance/Cable Type

PATCH JACK



PART NO. J-94

Panel thickness .312

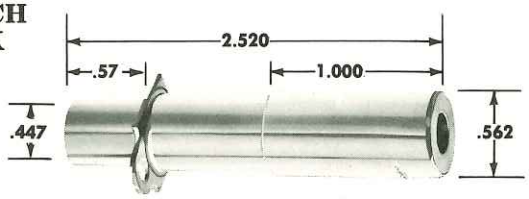
LOW VSWR ASSEMBLY

PRECISION PATCHING 75 OHM (COAXIAL)

The Trompeter designed 75 ohm precision patching is used where critical matching of cable and connector is required. The design is compatible with existing Western Electric and Lenkurt Electric coax patching in video, baseband, and I.F. carrier applications. The UJ3EW and UPLW, when used together, will provide return losses on the order of 35 dB (about 1.05:1 VSWR) at 70 MHz with the center pin diameter of .090. Cable types with 75 ohm impedance ±2 ohms, such as RG59/A, Belden 8281, 8270 and Western Electric types 724 and 728, are typical.

Many differing versions of jacks and plugs, too numerous to list in this series, can be supplied from existing hardware on special order.

PATCH JACK



PART NO. UJ-3EW (.090" pin)

PATCH CORD

PART NO. UPCW-L-75

75 ohm

UPCW — L

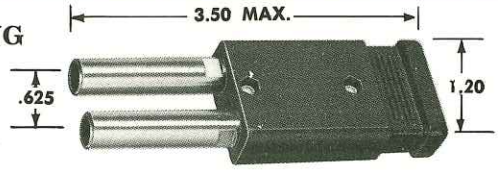
Precision Patch Cable

Length

PATCH PLUG

PART NO. UPLW (.090" pin)

LOOPING PLUG



PART NO. ULPW-75 (.090 pin)

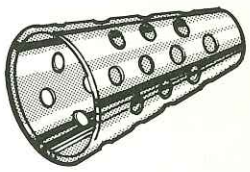
TEFLON JACKETED CABLE CONNECTORS

The increasing use of Teflon* jacketed cables in high temperature, chemical and aircraft environments requires better cable to connector reliability. Heretofore, the attachment of coax connectors to TFE jacketed cables have been plagued with all manners of failures, including shield separation from connector, and poor positioning of center contact pins.

Trompeter introduces a new connector to TFE cable attachment, designated T-LOCK, that virtually eliminates these failures by taking advantage of the cold flow properties of the TFE. This new connector-to-cable attachment cold flows the TFE jacket material into numerous holes in an anchor cone. The connector-to-cable pull to destruct approaches the tear strength of the cable. Like all other Trompeter connectors, the center pin is captive and the assembly is the same as illustrated on page 17.

When ordering connectors for TFE jacketed cables add the letter "T" after the part number, i.e. PL-25T.

* Trademark, DuPont Corporation. Teflon/TFE.



ANCHOR CONE

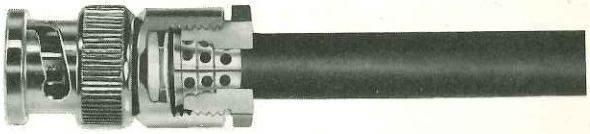
T-LOCK ANCHOR CONE ASSEMBLY

INSTRUCTIONS FOR ASSEMBLY OF COAXIAL CONNECTORS TO TEFLON* COAXIAL CABLES UTILIZING T-LOCK CONE TYPES: BNC/TNC/TPS/SMA

1. Slip back-nut onto cable.
2. Make a clean perpendicular cut through cable jacket, braid and dielectric, exposing 5/16" of center conductor.
3. Cut jacket back an additional 1/32 of an inch and bend braid outward to allow free entry of cone. This will prevent cone from forcing braid up under jacket.
4. Lightly tin center conductor.
5. Insert center conductor and dielectric into pin and cone assembly. Push edge of cone between dielectric and braid. Tapered cone will flair out braid and jacket. Continue to push cable into the cone until braid seats against shoulder. The center conductor should be visible in the pin solder hole.
6. Solder center conductor to pin.
7. Spread T-Lock cone open just enough to fit over cable, and position immediately behind flaired jacket, with small end of T-Lock toward back-nut.
8. Make sure small end of T-Lock cone fits cable snugly. Form around cable, with fingers if necessary. This will ensure entry into smallest step of back-nut.
9. Slide back-nut over T-Lock, continuing pressure until both lodged on tapered portion of cable.
10. Assemble body over pin/cone assembly and engage with back-nut.
11. Tighten assembly by holding back-nut rigid, and rotating body clockwise. This prevents cable from twisting and breaking center conductor.

* Reg. TM, DuPont Corp.

FULLY ASSEMBLED



Partial listing of Teflon* (TFE and FEP) cables that have been fitted with Trompeter standard or modified connectors. Pick the standard connector Part No. for BNC, N, SMA, etc.; Add — (cable group), and the letter "T". Examples: BJ-29-1T, PL-90-6CT, BJ-60-4T.

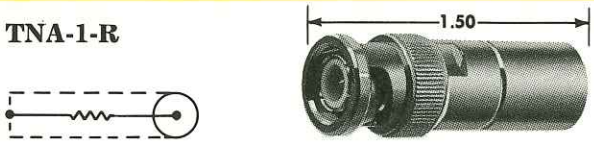
CABLE GROUP	CABLE O.D.	PART NUMBER OR MIL DESIGNATION	NOM. IMPED-ANCE (OHMS)	MANU-FACTURER	CABLE TYPE
1	.195	RG-142B/U	50	W. L. Gore	GWN1085
		RG-400/U	50		
2C	.270	C06D060A	50	W. L. Gore	
4	.160	295-3801	95	Microdot	
5	.100	RG-179B/U	75		Coaxial
		RG-187A/U	75		
		RG-188A/U	50		
		RG-316/U	50		
6C	.300	250-4207	50	W. L. Gore	C06D070
6D	.325	250-4208	50	Microdot	
21	.170	RG-303/U	50		
22	.141	RG-180B/U	95		
23	.140	275-3930	75	Microdot	Triaxial
		250-3884	50	Microdot	
24	.160	202-3934	160	Microdot	Twinaxial

CUSTOM COMPONENTS

INTRODUCTION

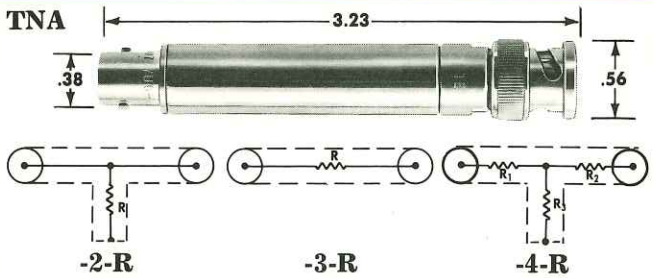
The pictured items reflect some of the many networks available for impedance matching, terminations, attenuators, transitions, and power dividers. Connectors should be specified when ordering.

TNA-1-R



Substitute resistance value in place of "R".

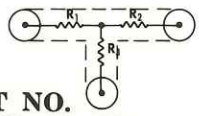
TNA



Substitute resistance value in place of "R".

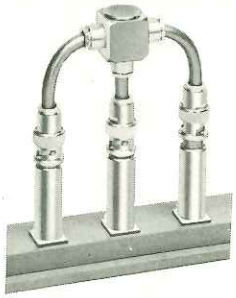
If ordered as an attenuator, the callout should be:
TNA - Impedance - Attenuation - Connectors
(TNA - 75 - 6 dB - BNC Male to Female)

POWER DIVIDERS



PART NO.
PD3-50, 75, 93Ω

Minimum Loss Pad
Allows paralleling of 3 jacks (BNC) with matched impedance.



MULTIPLE PARALLEL NETWORKS

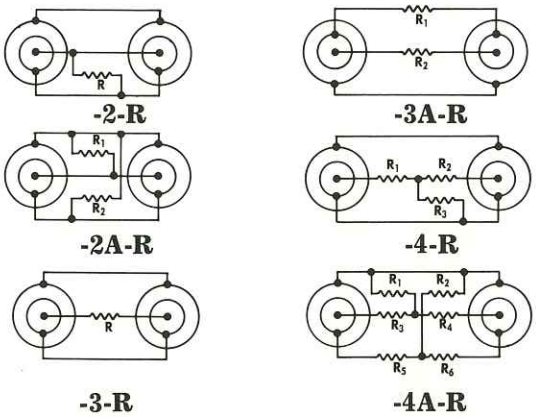
MPN-(X) Type of Connector 'BNC' coaxial
MTN-(X) Twinax Concentric Design

x = Number of receptacles desired.

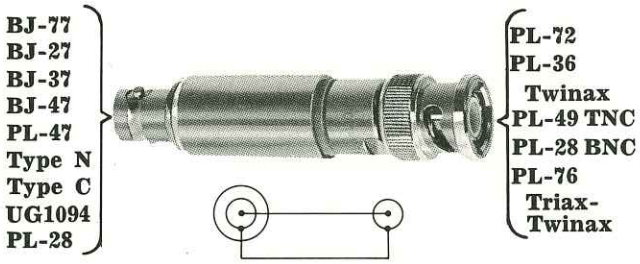
Allows paralleling of any number of coax and twinax jacks through a bulkhead mounted box (BNC receptacles). Other types of connectors available on special order.
Also available with passive networks.

TNG-1-R

TNG



TRANSITION TWINAX/TRIAX TO COAX



PART NO. TD - C - C
TD PL-28 BJ-77

Transition
Specify Male Connector
Specify Female Connector

The above network items, which are custom-made, can be furnished with any combination of types of male or female terminals. Transition devices may also be custom-configured both mechanically and electrically. Normally, the items are supplied with male and female terminals as illustrated.

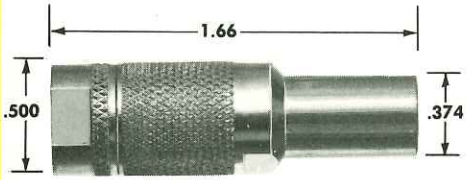
CUSTOM COMPONENTS

RFI OR DUMMY PLUGS

COAX
(J3)
RFI-1

TWINAX
TRIAX
(J72, BJ-77)
RFI-4
RFI-4A
with chain

MINIATURE
(J8)
RFI-6



TWINAX
TRIAX
(J72)
RFI-8

MONITOR PROBE

The MP-1 is a 10:1 video monitor voltage divider probe used with the J14 series or any standard coax jack providing minimum circuit loading.

PATCH CORD HOLDER

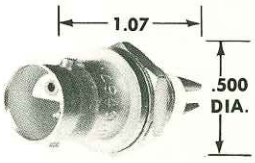
PART NO. CH-50

Black epoxy wall mount holder for 50 patch cords for use with ¼" dia. and smaller cables.

TWO PIN POLARIZED DESIGN

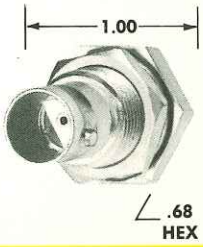
The two-pin series of twinax connectors shown below are not recommended for new systems and should be considered for replacement purposes only. The concentric design is preferred since it does not require mechanical alignment for mating.

PART NO. BJ-37
BULKHEAD JACK
Mates with PL-36/PL-37

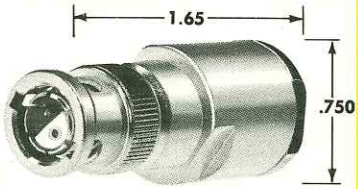


PART NO. PL-36
For Trompeter ¼" Twinax
TWC — (78 or 124)-2

PART NO. BJ-39
CABLE JACK/
BULKHEAD MOUNTING
Mates with PL-36/PL-37
For cable group #9

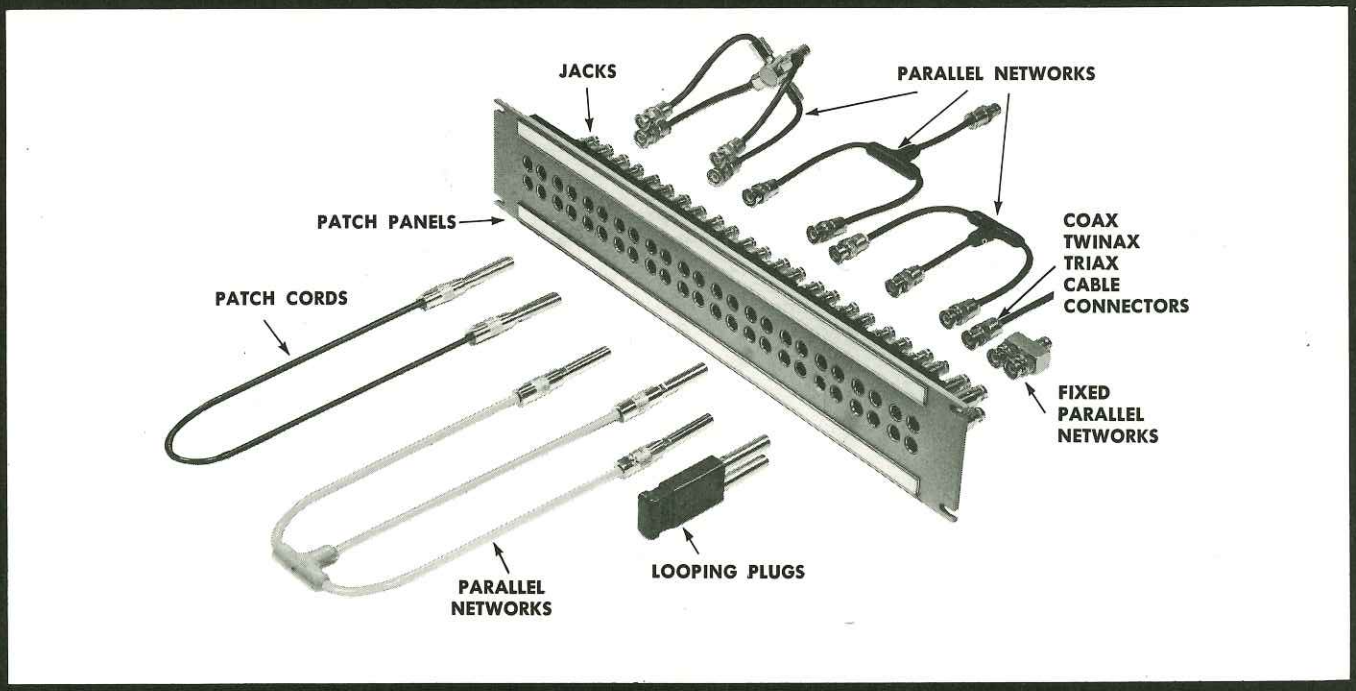


PART NO. PL-37
For W.E. 754E (124Ω) and cable group #10

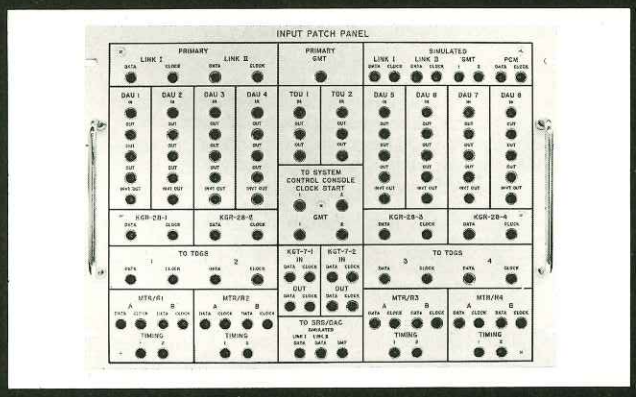


PART NO. BJ-38
FEED-THRU
BULKHEAD MOUNTING
Mates with PL-36/PL-37

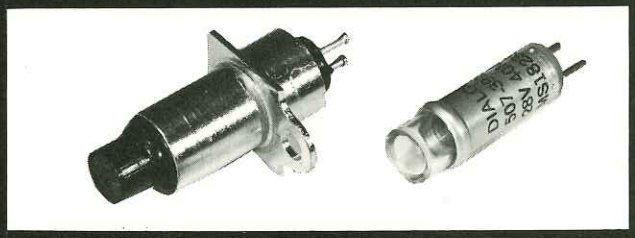
TYPICAL PATCHING SYSTEMS



PATCHING COMPONENTS

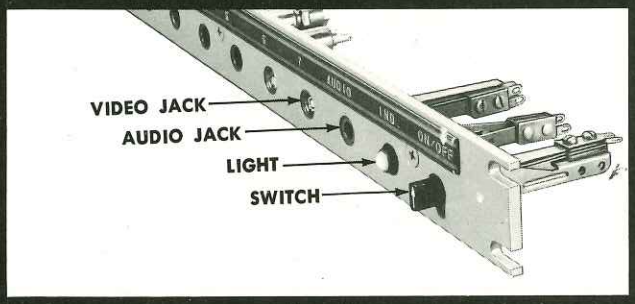


INPUT PATCH PANEL



TYPE LS-100

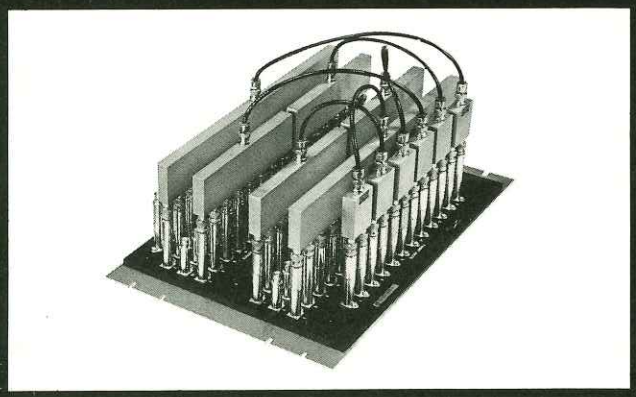
Jack panel light socket. Consists of a "bi-pin" lamp base in a jack body which will accommodate T1¾ incandescent or light emitting diodes. Lamps not included.



AUDIO & TELEPHONE JACKS

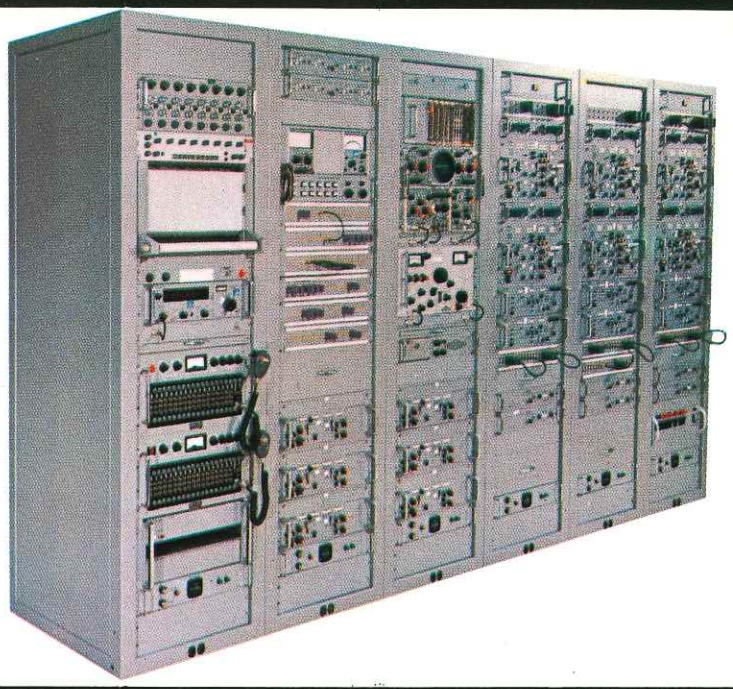
Audio jacks, lights and turn switches can be supplied and mounted interchangeably or mixed with video coax, twinax, or triax jacks. Mixed audio video jacks can be mounted on the same panel for simultaneous audio and video patching.

Quotations can be supplied on complete audio patch bays built to customer design. Our Engineering staff is available to assist in determining your requirements.

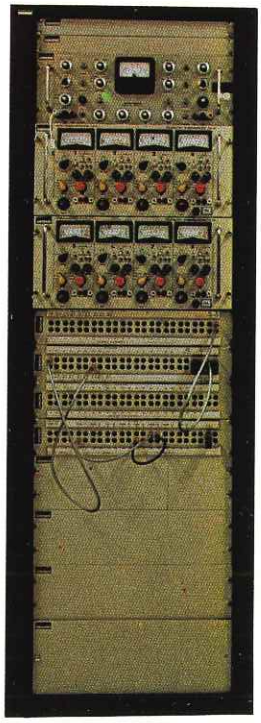


PATCH PANEL WITH SPECIAL NETWORKS

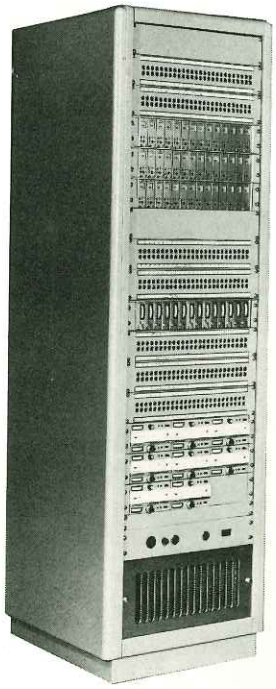
TYPICAL PATCHING SYSTEMS



PATCHING USED IN LARGE TELEMETRY SYSTEM



DISTRIBUTION PATCHING



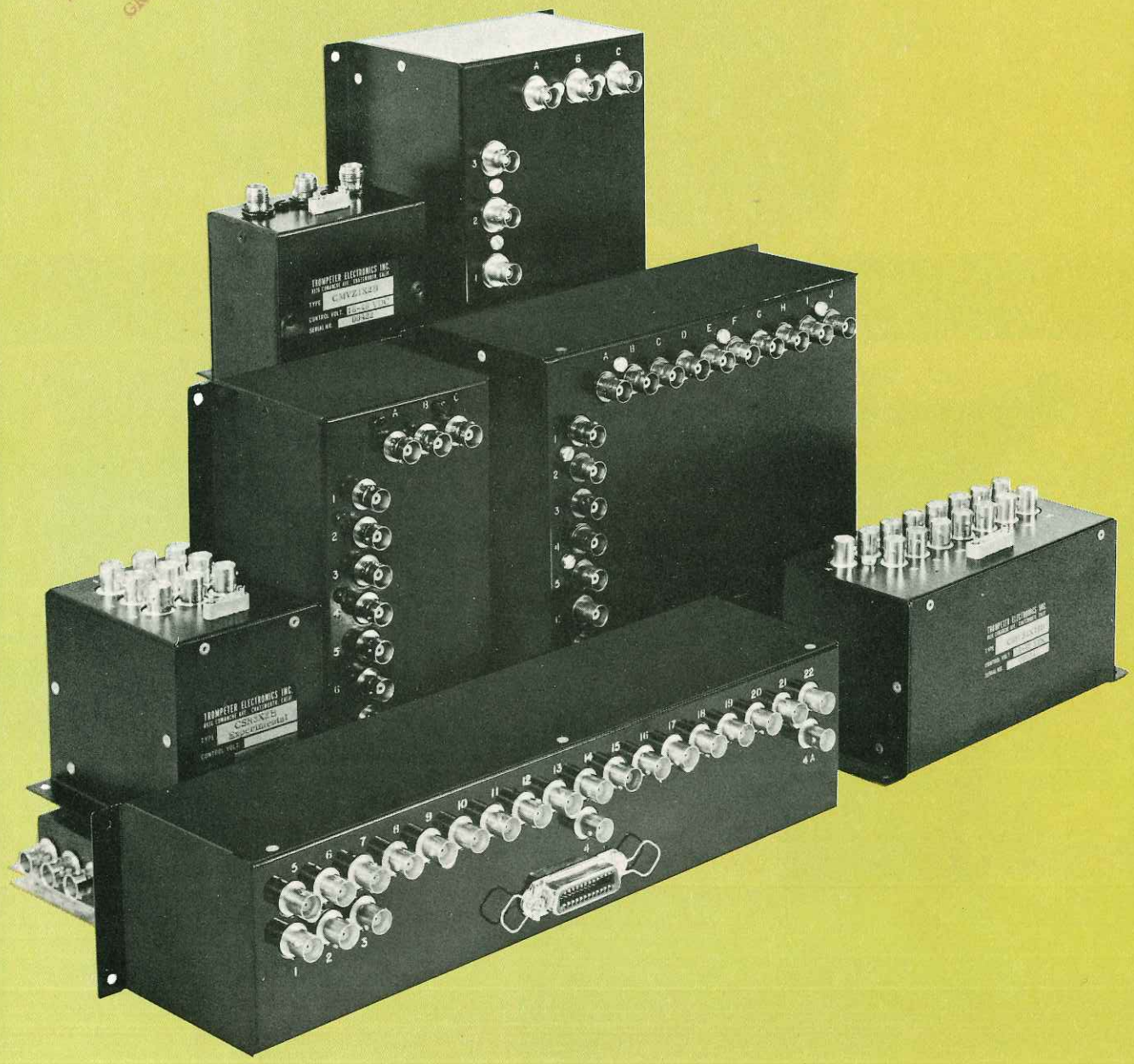
TYPICAL PATCH BAY

COAXIAL SWITCHING

SWITCHING DEVICES FOR:

- **COMPUTER**
- **TELEMETRY**
- **VIDEO**
- **HF, IF AND VHF**
- **AUTOMATIC CHECKOUT**
- **PROCESS CONTROL**
- **ANALOG & DIGITAL, DC TO 3 GHz**

RECEIVED
AUG 27 1973
GROUP 230



INTRODUCTION

The coax switches, matrices and systems presented in this section were specifically designed to provide the ultimate in versatility and capability. They cover a frequency range from DC or low frequency (shielded audio, analog, digital, pulse, video) to 3.0 GHz or high frequency (I.F., R.F.) where impedance matching or shielding integrity must be maintained.

While the preceding patching section is concerned with "manual" programming, this section presents the most sophisticated and remotely controllable devices. The matrices and switches described provide the engineer with the capability for improved systems performance with minimum difficulty and hardware.

Each type of matrix or switch is defined and elecrical characteristics of each delineated in the following sections, generally classified according to frequency. All matrices and switches are custom-built in order to satisfy the most exacting requirements of the engineer and to provide flexibility of size and electrical characteristics. This philosophy permits the designer freedom to optimize the system around function rather than restrictive hardware by providing the exact switching required. Customizing also insures flexibility in that hybrid matrices or switches containing integral logic, power supply or other functions can be provided.

As communication and data transmission systems become more complex, the need for more efficient switching systems becomes evident. The following pages provide data for the systems and design engineers. Our Engineering Department is available to assist in determining your requirements and interfacing them with our capability and experience.

APPLICATIONS

The need for remotely controlled switching systems having increased speeds, greater flexibility and broader usage is in greater demand than ever before to perform complex, as well as simple tasks.

Trompeter Electronics offers matrices and multipole multi-throw switches built to meet the most exacting requirements. Heretofore, only the simplest coax relays were available to satisfy customer switching needs. Utilizing advances in technology developed by Trompeter, matrices and switches can now be customized to include self-termination, isolated switched shield in coax, twinax and triax from DC to 3 GHz.

Since the switching elements are passive and bidirectional, a one-pole, four-throw switch can be used as one input-four output or four input-one output. This feature is particularly desirable when using the switch as a scanner, multiplexer or commutator. Manual patching may be replaced by a matrix which provides for simple, high speed, extremely versatile, remotely controlled operation.

As VSWR is a function of frequency and the hardware the signal must pass through, the development of separate High Frequency and Low Frequency units was necessary. The Low Frequency units are excellent up to 60 MHz with little stub effect. Above 60 MHz, the stub effect becomes apparent and degradation of VSWR takes place. Special crosspoint "stub cutoff" features in the High Frequency matrices disconnect all extraneous hardware and unused open circuit transmission lines from the signal path. High frequency matrices and switches may be used up to 3 GHz. The above features make the Trompeter high-frequency switches and matrices ideal devices for random switching of antennas to receivers or similar VHF/UHF applications where low VSWR is a requirement.

Complete turnkey switching systems can be furnished, including control logic (DTL or TTL), lighted push-buttons or any other equipment to mate with the most complicated computer control logic.

INDEX

	Page
Video to 60 MHz	45-49
Typical Switches	50
High Frequency to 3 GHz	51-53
Microwave I.F.	54
Low Frequency	55-56
Systems and Control	57-58
Typical Systems	59-60

MATRICES

Matrices are crosspoint switching mechanisms which have MULTIPLE inputs and MULTIPLE outputs, wherein any input can be connected to any of one or more outputs, with numerous paths thru the matrix being available simultaneously.

A 5X5 matrix has 25 crosspoint relays that can be operated independently, and by feeding DC voltage to the appropriate crosspoint coil, any input can be connected to any output.

Matrices can also be "added" in modular fashion to make larger switching systems. For instance, two 10X10 matrices can make up into a 10X20 matrix, or four 10X10 matrices can make up into a 20X20 version.

In some instances, multiple matrices can be packaged in one box making a multilevel version available for simplicity of wiring and installation.

In cases where all crosspoints are not needed, matrices can be furnished with certain crosspoints eliminated, thereby providing additional savings over other forms of switching. Extra convenience features can be added at the time of manufacture as follows:

1) Separate relay contacts outside the signal circuits can be provided for remote indication, tally or display.

2) "Self-termination" of any input or output signal circuit in any resistance value designated.

3) Simultaneous switching of video and audio signals.

MULTIPLE RELAYS

Using the same mode of construction as designed into the crosspoint matrix, single-pole multi-throw or multi-pole multi-throw coax, twinax, and triax relays are available for the same applications as the matrix. In effect, they are a number of single-pole multi-throw relays in one box; i.e., five 1X10 relays make up into 5-pole 10-throw relay.

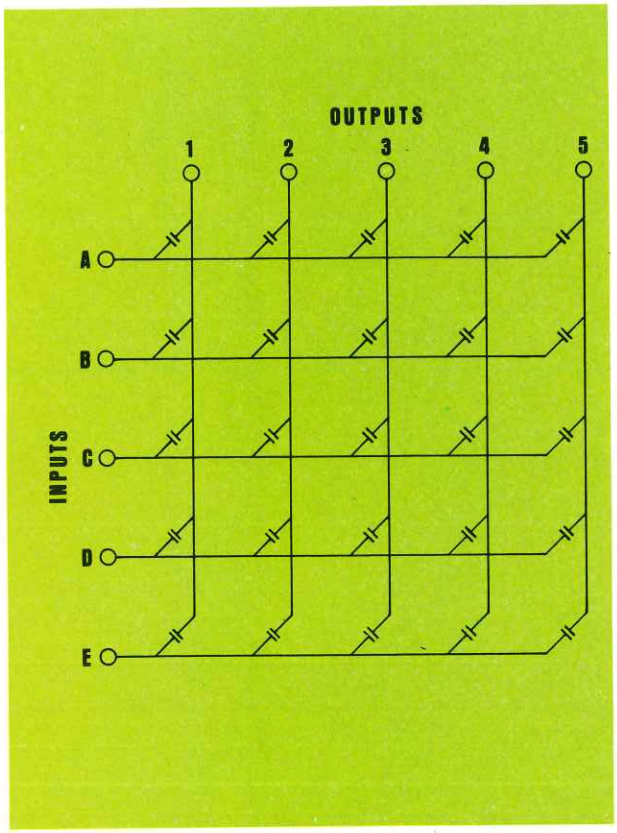
SCANNERS, MULTIPLEXERS

Trompeter Electronics manufactures single-pole multi-throw coax relays containing control logic for use as scanners, multiplexers, commutators and sequencing switches.

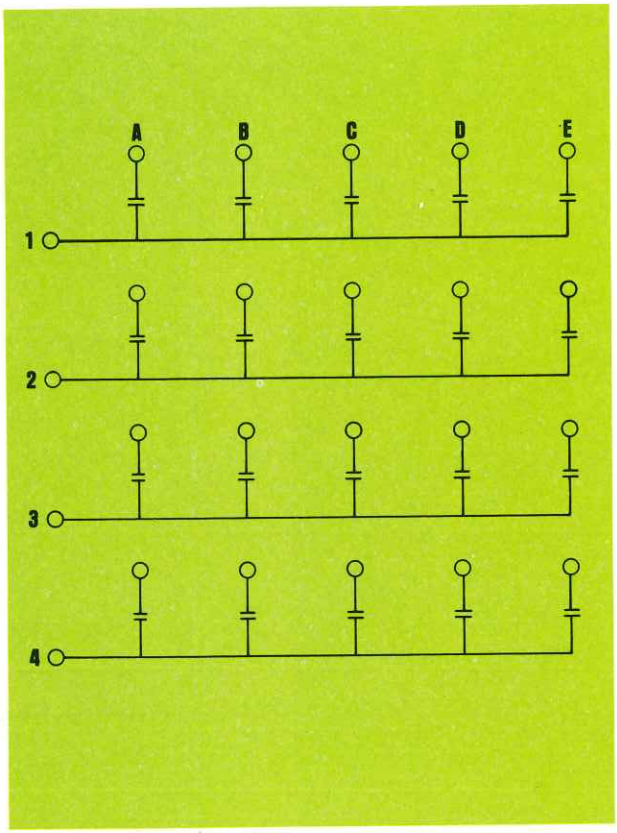
LOW FREQUENCY ELECTRO-MECHANICAL SWITCHES

Trompeter Electronics has also developed a new line of electro-mechanical devices for low level transducer switching, process control, and plant automation in DC and low frequency applications (see pages 55 and 56).

TYPICAL MATRIX



TYPICAL SWITCH



VIDEO TO 60 MHz

DEFINITIONS AND TERMS

CROSSTALK: Unwanted coupling, measured in dB, between adjacent circuits (input to input, output to output).

ISOLATION: Leakage coupling measured in dB, input to output across open switch.

INSERTION LOSS: The total dB transmission loss from input terminal to output terminal through a closed switch.

VSWR: Voltage standing wave ratio introduced by the switch/matrix only.
Voltage standing wave ratio $= E_R/E_I = \sqrt{P_R/P_I} =$ reflection coefficient.

RETURN LOSS: VSWR restated in terms of dB, dB $= -10 \log P_R/P_I$ or $-20 \log E_R/E_I$.

CONTACT RESISTANCE: The total DC resistance from input to output terminals including wiring and switch contact.

ACTUATION PULL-IN: Total time required to close switch contact from application of control voltage to end of bounce.

TRANSFER SWITCHING TIME: Total time required for contact transfer, including bounce. Not including coil buildup or decay.

DROP-OUT: Time interval from coil de-energization to opening of switch contact.

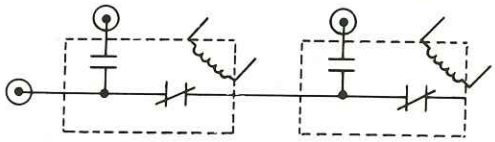
INPUTS: Signal source terminals of matrix or switch.

OUTPUTS: Signal load terminals of matrix or switch.

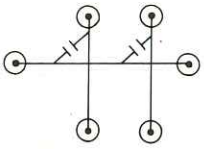
LATCHING: Circuit contact maintained in the last position assumed (electrical or no power magnetic).

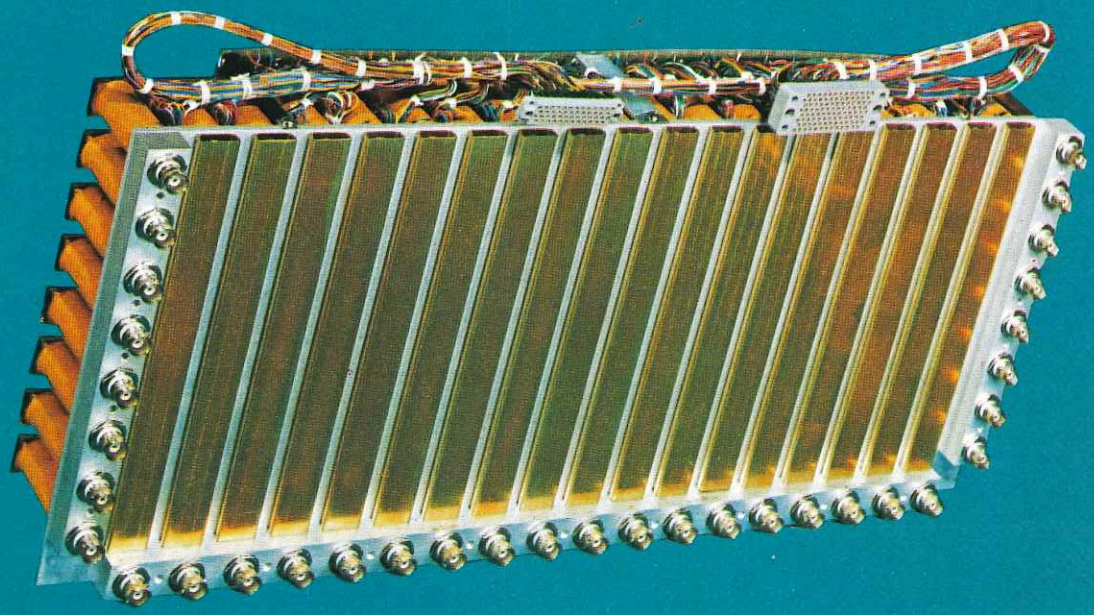
INTERLOCK: Permitting only one switched condition in the X and/or Y axis either mechanically or electrically.

STUB CUTOFF: Disconnecting any unused open circuit transmission lines from the signal path.



EXPANDABLE: Addition of X and/or Y terminals to permit series connection of multiple units. This limits the upper frequency unless stub cutoff is used.





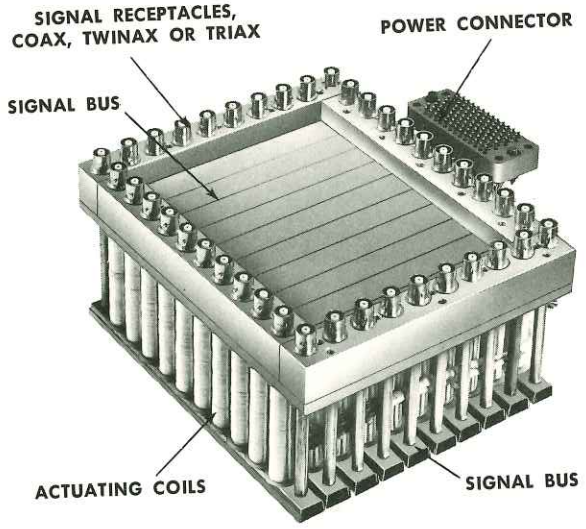
Typical coaxial matrix where center conductor and shield are switched simultaneously. (Cover removed)

VIDEO TO 60 MHz

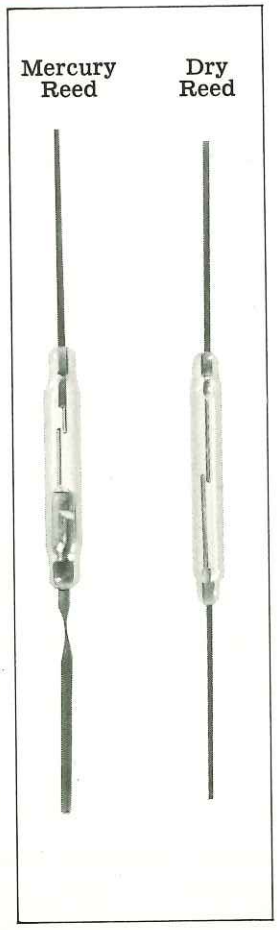
LOW FREQUENCY SWITCHING (Below 60 MHz) GENERAL OPERATION AND CONSTRUCTION

Switching devices are available in crosspoint matrices and multipole-multithrow relays. Both are manufactured for switching shielded wire, coax, twinax and triax cable systems in various configurations of size, electrical characteristics and job function. The complete unit is packaged in a copper-plated steel container, the copper providing low "skin" impedance bypassing to ground for **capacitive** field interference reduction with the steel providing shielding against **magnetic** field interference. The use of these materials is absolutely necessary if external noise sources are to be eliminated or signal security maintained. All units are painted Color 111 of MIL-E-15090B.

The matrices or multiple relays are actuated by DC voltages and can be remotely controlled by a simple toggle or lighted push button panel, preprogrammed punched card, sequential timer, telephone dial, thumbwheel switch or computer controlled logic for automatic checkout applications. They will allow quick, accurate and repeated test setups without the necessity for making and breaking connections by operator personnel.



View of 10 x 10 Modular Matrix (less enclosure).



SWITCHING ELEMENTS

Two types of glass reeds are used to accomplish low frequency switching — dry contact and mercury wetted. A choice must be made between the two depending upon the type of signal transmitted and performance desired. Mercury wetted reeds are somewhat more expensive than dry reeds, but have some distinct electrical advantages listed and discussed below:

	DRY CONTACT	MERCURY WETTED
Series Resistance (new)	70 Milliohms nominal	50 Milliohms nominal
Series Resistance	Good, Resistance increasing with current load and usage.	Excellent, remaining constant, due to the capillary rewetting of the contact surfaces.
Current overload surges	Fair with no recovery	Excellent, with surface repair by mercury rewetting.
Contact Bounce	Yes, damped within 0.3 milli-second	None
Low Contact Noise	Good	Excellent
Life	Good ($20x10^6$)	Excellent ($100x10^6$)
Mounting	Any position	Position Sensitive

The choice of magnetic reed to specify depends upon the type of signal and amount of current passing thru the reed. Since the mercury wetted reed has extremely long life, no contact bounce, low contact resistance and ability to repair itself by constant rewetting of the contacts, it is recommended that they be used in the following applications:

a) High surge current applications.
b) Dry circuit (80 Millivolt or less).
c) Digital or other applications where contact bounce or switch noise could degrade circuit performance or reduce the signal to noise ratio.
d) Circuits where insertion loss (contact resistance) must be constant and repeatable for every switch closure over the normal reed life expectancy.

When reeds are used to switch other than signal circuits, such as lamps or any reactive load, consideration should be given to the surge charge and discharge currents to be encountered that would greatly reduce the life of the reed. For instance, indicating incandescent lamps have turn on current surges approaching ten times the steady state flow. Current limiting resistors of mercury wetted reeds may be required to give good performance. Where applications require high voltage switching and standoff, or other special switching requirements, special reeds can be supplied, after discussion with our engineering department. Dry contact reeds are excellent for all other types of switching, provided the switched current and voltage ratings are not exceeded. Should a reed switch fail, it can be easily replaced by field personnel using simple hand tools.

VIDEO TO 60 MHz

GENERAL SPECIFICATIONS

MAXIMUM SWITCHED SIGNAL CURRENT:	Dry Reed: 0.5 amp, non-inductive. Mercury Wetted: 1 amp, non-inductive.
CONTROL VOLTAGE:	Dry Reed: 18 to 48 volts d.c. Mercury Wetted: 24 to 48 volts d.c. For low-voltage transistor driven circuits, dry reed crosspoints with 5-volt d.c. closure can be provided.
CONTROL CURRENT:	1 milliamp per applied volt per crosspoint, 18-48 Vdc. 8 milliamps per applied volt per crosspoint, 5 Vdc.
VSWR:	1.25:1 at 60 MHz nominal. Varies with size of unit and frequency.
ACTUATION TIME:	1 millisecond dry reed. 2 Milliseconds mercury.
SIGNAL CONNECTORS:	BNC (Coax), Concentric Twinax (Video Pair), Triax, other types available on special order. Mating plugs are available and may be ordered as separate item.
POWER CONNECTOR:	Winchester mated pair are supplied with each unit. Other types are available on special order.
LIFE EXPECTANCY:	Dry Reed: 20 million closures per contact at full rated current. 100 million for dry circuit switching. Mercury Wetted: 100 million closures at full rated current (conservative).

Standard matrices and switches are supplied with all crosspoints normally open.
Normally closed dry reed crosspoints can be supplied if required.
Specification figures indicated are typical and not maximums.

ELECTRICAL CHARACTERISTICS

			OPEN CROSSPOINT ISOLATION IN dB* MHz			
	TYPE	**VERSION**	**60**	**15**	**3.5**	**CLOSED CONTACT RESISTANCE MILLIOHMS**
DRY REED	A	Low Isolation	55	67	79	150
	V	Medium Isolation	75	87	99	250
	R	High Isolation	110	122	134	250
MERCURY WETTED REED	F	Medium Isolation	60	72	84	100
	G	High Isolation	90	102	119	150

* NOTE 1: Isolation is a function of frequency with approximately 6 dB per octave rolloff. Isolation values are also a function of unit size and configuration.
NOTE 2: For frequencies above 60 MHz, high-frequency units shown on pages 51 and 52 should be used.
NOTE 3: Due to variation of reed manufacture, isolation may vary 10%.

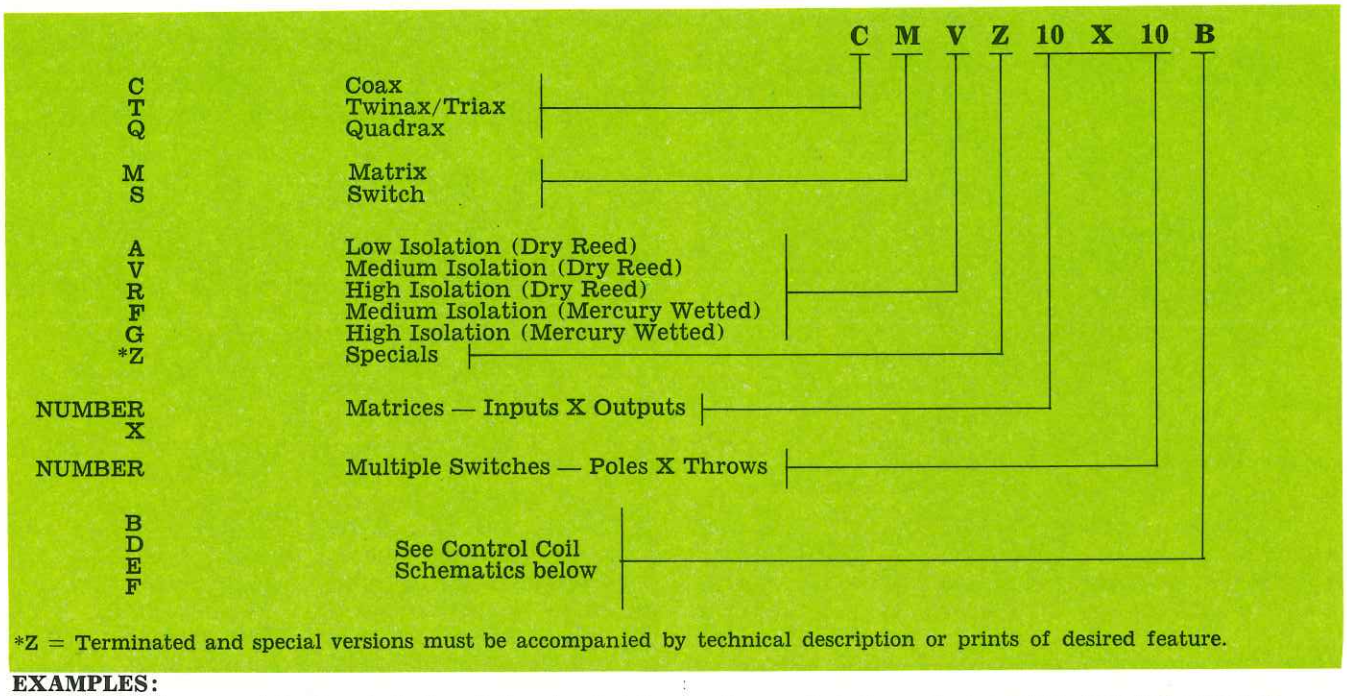
TYPICAL SPECIFICATIONS CMV 7x7B

FREQUENCY	Max. to 10 MHz	20 MHz	30 MHz	60 MHz
CROSSTALK	80 dB	80 dB	80 dB	80 dB
ISOLATION	82 dB	78 dB	76 dB	70 dB
VSWR	1.13 : 1	1.33 : 1	1.40 : 1	1.73 : 1
INSERTION LOSS	0.2 dB	0.2 dB	0.3 dB	0.5 dB

Data will vary with the size of the matrix switch and the crosspoint tested.

VIDEO TO 60 MHz

PART NUMBER AND ORDERING INFORMATION



*Z = Terminated and special versions must be accompanied by technical description or prints of desired feature.

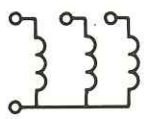
EXAMPLES:

CMA5X3B: Coax, matrix, low isolation, 5 inputs, 3 outputs, dry reed, independent control isolated common.

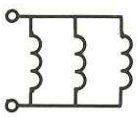
CMG6X4B: Coax, matrix, high isolation, 6 inputs, 4 outputs, mercury reed, independent control, isolated common.

CSV4X2D: Coax, switch, medium isolation, 4 pole, 2 throw, dry reed, common control, ungrounded.

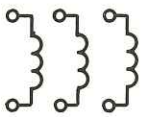
CONTROL COIL CONFIGURATIONS



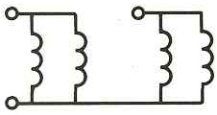
"B" Independent Control Isolated Common



"D" Common Control Ungrounded



"E" Independent Control No Common



***"F Independent & Common Control For Ganged Switching Requirements Isolated Common**

* Must be accompanied by specifications as to which crosspoints are to be common.

SPECIAL FEATURES TO BE CONSIDERED AND DEFINED:

A) Self-Termination; Input, output or both thru a dry switch contact. Resistance in ohms, wattage and % accuracy of resistor.

B) Normally closed — slight reduction in isolation.

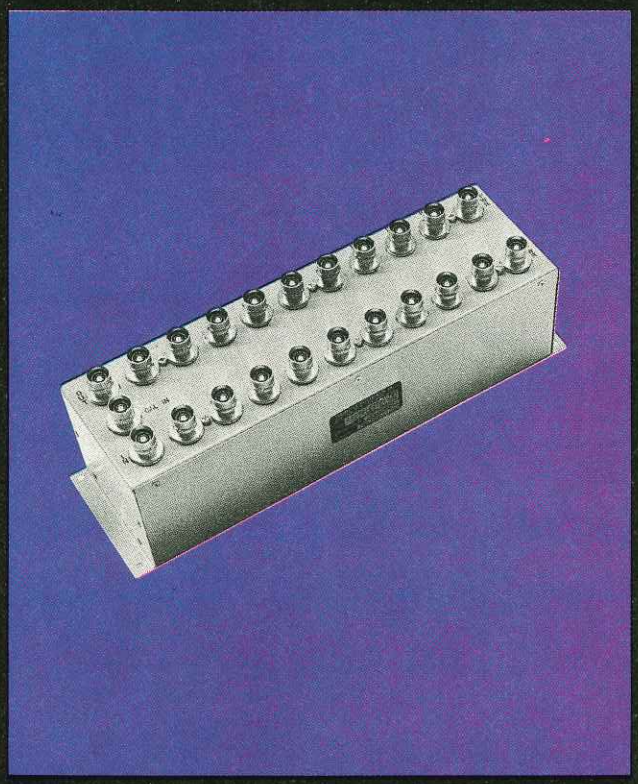
C) If other than grounded coax is switched, should the coax shield be ungrounded at the switch, or should the shield be ungrounded and switched also? A good VSWR cannot be maintained above 10 MHz if the shield is switched, since discontinuities will occur when changing from unbalanced to balanced to unbalanced through the crosspoint. Switching the outer braid is suggested for use where low frequency (under 500 kHz) signals are transmitted which are subject to ground loop or common mode interference.

D) Diode suppression across the coils; required if control coil is solid-state-driven.

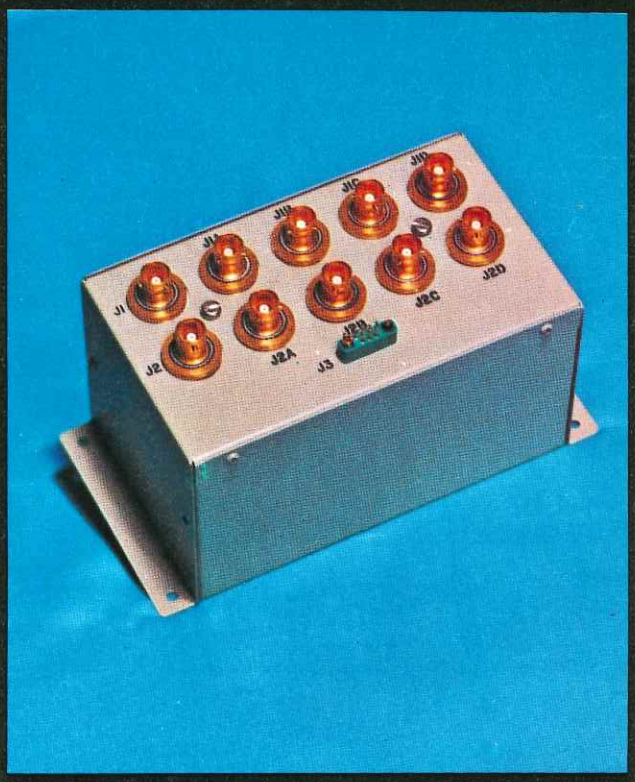
E) Deletion of certain unneeded crosspoints to reduce cost.

F) Expandable switching systems using modular matrices with inter-module cabling in the X and/or Y axis.

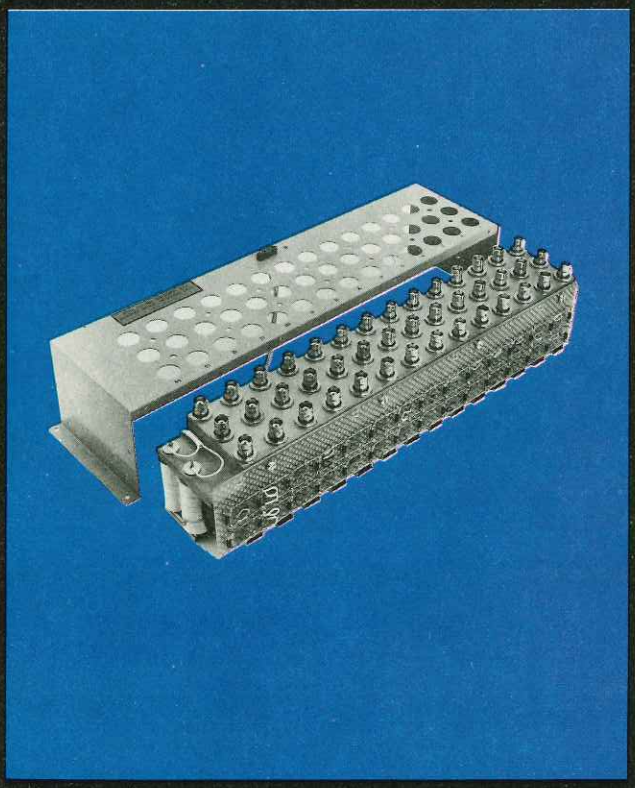
VIDEO TO 60 MHz



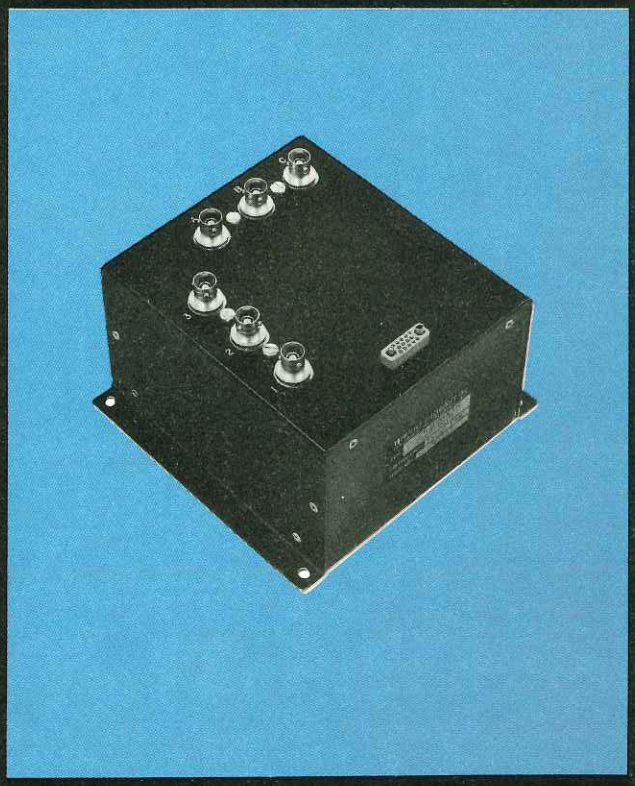
Four circuit switch for use with quadrax cable in a secure communications system (Part No. QSAZ10X2D).



Two pole four throw triax switch with outer braid insulated from case (ground).



Fourteen pole two throw switch, coax shield insulated from ground (cover removed).



Three input by three output triax matrix.

HIGH FREQUENCY TO 3 GHz

HIGH FREQUENCY (I.F. & R.F) SWITCHES AND MATRICES (60 MHz-3 GHz)

Trompeter Electronics has developed a **new** proprietary broadband switching technique employed in the making of high frequency matrices and multipole-multithrow switches specifically designed for routing of I.F. and R.F. signals where low VSWRs are required. These units are constructed utilizing special crosspoint relays, not only having low VSWR and high isolation, but also incorporating a "stub cutoff" feature that isolates the signal being transferred from any extra wiring or hardware discontinuities encountered in the switching system. This feature also precludes the operation of more than one crosspoint in any one X-Y axis. In other words, the individual crosspoint relay, when actuated, isolates all vertical and horizontal signal path stubs, discontinuities and connections beyond the switched crosspoint. The switching units are furnished in any reasonable crosspoint configuration, customized to meet specific input to output requirements.

It is recommended that this stub cutoff switching construction be used for **all** signal distribution above 60 MHz. Many applications below 60 MHz may also require this technique due to the stubs encountered or the need for an extremely low VSWR. Our engineering staff can advise which type of switch or matrix would best meet your R.F. requirements. These switching units can handle any R.F. signal from dry circuit microvolts to 50 watts of power.

Crosspoint switch control is accomplished by supplying D.C. voltage to the individual crosspoint. Full matrix switching crosspoint can be accomplished remotely using lighted push-buttons, thumbwheel or touch tone switches, or by any computer code to Trompeter supplied decoder logic-relay driver assemblies. See Systems section for TEI remote control capability.

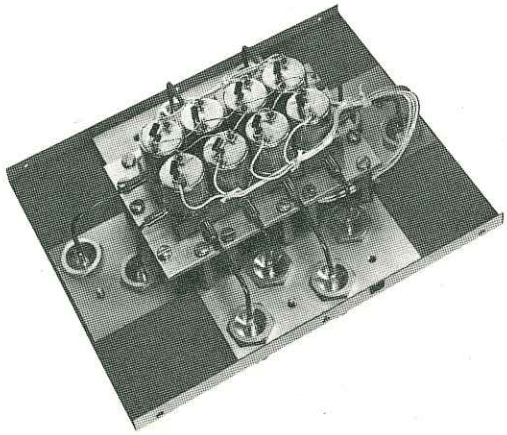
50 Ohm Applications. The 50 ohm versions are usable for I.F. and R.F. signal switching applications in communications, surveillance, telemetry and similar applications where antenna, multicoupler and receiver inputs require extremely low VSWR routing. Fast rise time **digital pulses,** often having frequency components up to the GHz range, must also utilize coax cable, connectors, and switching capable of passing the pulse with minimum degradation, reflections or losses while still maintaining high isolation and low crosstalk.

75 Ohm Applications. The 75 ohm versions are usable for cable TV distribution systems where the undetected I.F. or R.F. is distributed as in school, hospital, security or similar installations.

Telephone and Microwave Applications. A special 75 ohm version is also available for carrier baseband and I.F. applications where **individual** crosspoints are supplied complete with connector or patch cord input and output so that any configuration or size of switch or matrix can be changed on a day by day basis. The unit was designed to be smaller, lighter, less expensive and electrically improved over similar switches now in use (W.E. Co. 223, etc.). Isolation of greater than 130 dB with 40 dB return loss measured at 70 MHz is attained for each crosspoint.

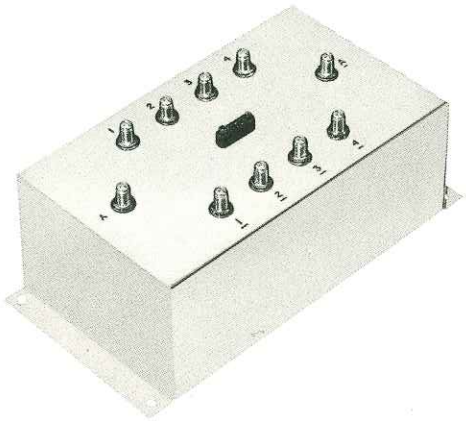
Design and construction of entire switching systems are available from TEI, and our applications engineering staff is available to assist in determining your particular switching needs.

HFMAZ 2 x 4 Matrix ("N" Connectors)



Underside HFMAZ 2 x 4 (Less Cover)

HIGH FREQUENCY TO 3 GHz



Typical high frequency matrix with SMA connectors. Modular in design, expandable in X-Y axis.

GENERAL SPECIFICATIONS FOR HIGH FREQUENCY MATRICES AND SWITCHES

SIGNAL POWER: 50 watts carry.

CONTROL VOLTAGE: 28 VDC nominal.(A)

CONTROL CURRENT: One milliamp per applied volt.

VSWR: 1.25:1 at 2.5 GHz for a typical 3X5 matrix.(B)

ACTUATION PULL-IN TIME: 8 milliseconds.

SIGNAL CONNECTORS: SMA for 50Ω systems.(C) 75 ohm BNC for 75 ohm systems.(D)

POWER CONNECTOR: Winchester (mate is supplied).

ISOLATION: 40 dB at 2.5 GHz.(E)

CROSSTALK: 62 dB at 2.5 GHz.(E)

TRANSFER TIME: Less than 5 milliseconds.

MECHANICAL LIFE: $1X10^6$ cycles.(F)

NOTES:

(A) Other voltages are available.

(B) Will vary with size of matrix and signal frequency.

(C) Other available connectors that can be specified: BNC usable to 500 MHz. N for large cable systems (RG-8, 213).

(D) Mating 75 ohm BNC plugs available from TEI.

(E) Will vary with signal frequency.

(F) Electrical life is a function of operating rate and load, as well as environmental conditions.

50 OHM TYPICAL SPECIFICATIONS HFSA 3X5B

FREQUENCY BAND	550 MHz	1 GHz	1.5 GHz	2.5 GHz
VSWR MAX.	1.12	1.14	1.14	1.17
CROSSTALK	>130 dB	>124 dB	>115 dB	>108 dB
ISOLATION	50 dB	45 dB	41 dB	38 dB
INSERTION LOSS	1.2 dB	1.75 dB	1.95 dB	2.25 dB

HIGH FREQUENCY TO 3 GHz

HIGH FREQUENCY SWITCHING UNITS (60 MHz TO 3 GHz)

Switches **H F S A Z 2 x 4 B**

- B — Control Coil Configuration
- 4 — Throws
- 2 — Poles
- Z — Special Requirements*
- A — A = 50 ohms, B = 75 ohms
- S — Switch
- H F — High Frequency

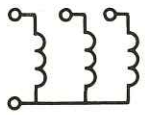
Matrices **H F M A Z 2 x 4 B**

- B — Control Coil Configuration
- 4 — Outputs
- 2 — Inputs
- Z — Special Requirements*
- A — A = 50 ohms, B = 75 ohms
- M — Matrices
- H F — High Frequency

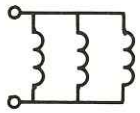
*Z = Terminated or special versions must be accompanied by technical description or prints of desired feature.

Examples:
HFMA5X3B: Coax, Matrix, 50 ohms, 5 input, 3 outputs, independent control, isolated common.
HFSAZ4X2D: Coax, Switch, 50 ohms, 4 pole, 2 throw, common control, ungrounded.
Z = 50 ohm Termination, Expandable, Special Connectors.

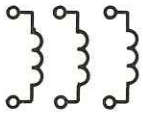
CONTROL COIL CONFIGURATIONS



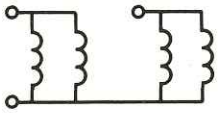
"B" Independent Control Isolated Common



"D" Common Control Ungrounded

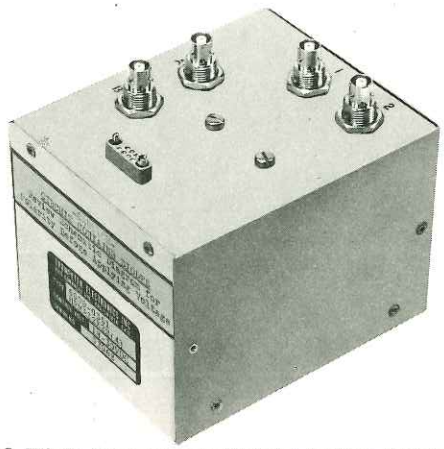


"E" Independent Control No Common

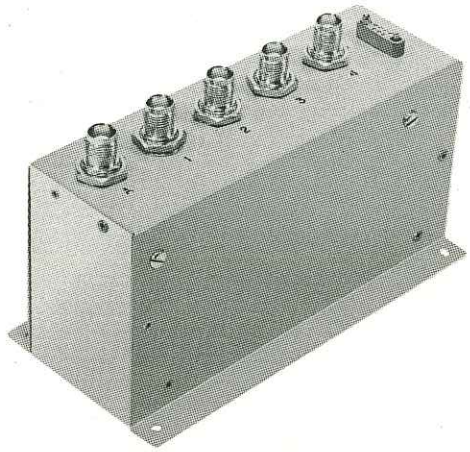


***"F Independent & Common Control For Ganged Switching Requirements Isolated Common**

* Must be accompanied by specifications as to which crosspoints are to be common.



2 x 2 High Frequency Matrix Using Miniature Connectors (TPS).



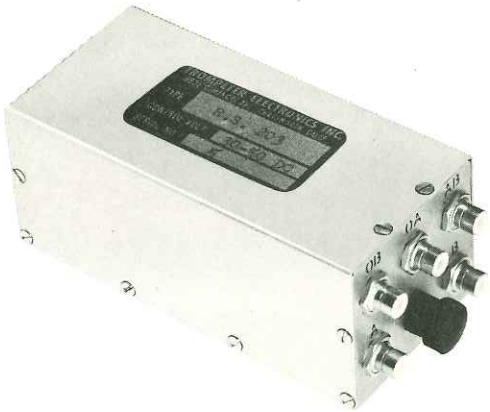
One Input Four Output High Frequency Switch (TNC Connectors).

75 OHM SWITCHING RELAYS

Trompeter Electronics manufactures precision 75 ohm broadband coax relays having high isolation and high return loss for use in microwave carrier systems for baseband and I.F. restoration protection switching. The relays are also usable in CATV and CCTV R.F. cable distribution systems where origination or routing switching is required. Using these relays, crosspoint matrices and multipole-multithrow switches may be configured in any reasonable size or configuration. Individual crosspoint relays with isolation better than 120 dB at 70 MHz can be supplied.

Complete switching systems are assembled from relays packaged in various ways as follows:

Matrices and switches are mounted in an equipment box with both signal and power connectors brought out to the box surface. These complete units are ready to use with the mating power connector also provided.



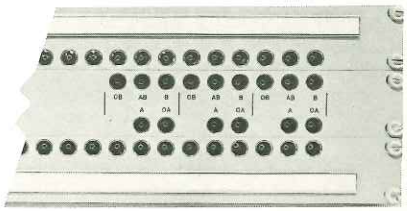
Crosspoint relays are furnished in individual modules that fit into a pigeonhole chassis. They can be supplied with either 75 ohm coax patch jacks or connectors brought out to the front surface. This arrangement provides for expansion and interconnection using coax cable assemblies. The pigeonhole chassis, patch cords, looping plugs and cable assemblies are supplied as separate items.

A terminated version of the relay can also be supplied which provides for the automatic termination of one of the signal lines when the second is switched from its normal through path.

Additionally, a 75 ohm "transfer" version is available for individual assembly in switching systems where transfer types are required.

In view of the fact that an unlimited number of mechanical and/or electrical configurations are available, we suggest that consultation with our engineering staff be made in order that an optimum switching system will be supplied.

A number of matrix crosspoint relays are mounted on the back of a patch panel permitting the user to configure any reasonable arrangement of switching by patching. In addition, an operate lamp is provided that indicates when the relay is in the transferred mode. This can be accomplished by using W.E. 75 ohm patch cords or Trompeter type precision 75 ohm patching components shown on page 37. The bottom photo depicts a section of a typical patch panel.



LOW FREQUENCY

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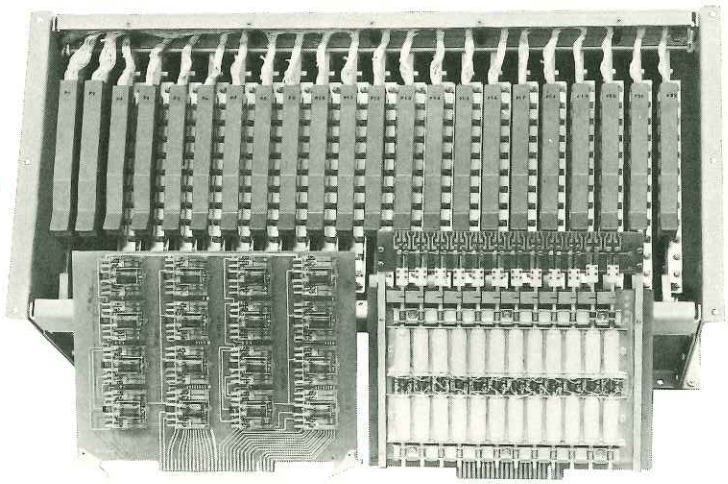
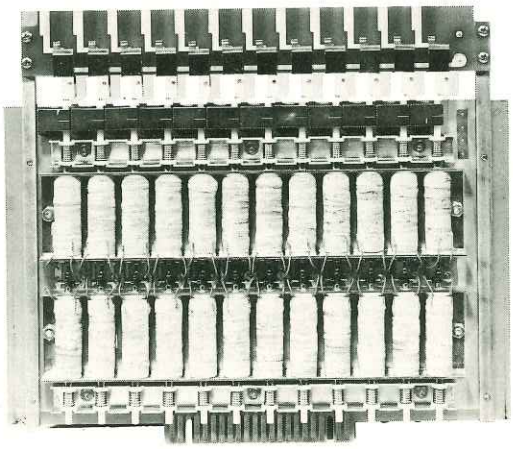


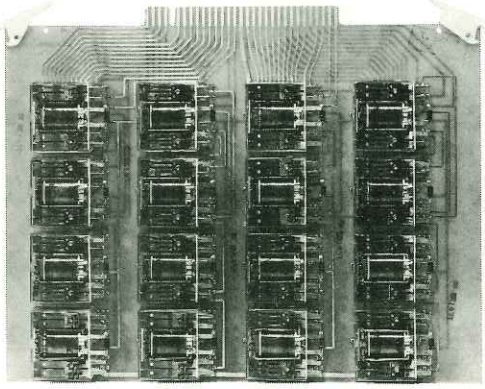
SLIDING CONTACT MODULAR SWITCH

Trompeter Electronics introduces a new low frequency, 4-pole, 24-throw sliding contact modular switch which offers unprecedented design features and application flexibility. The switch may be configured as a multi-pole, multi-throw unit or as a matrix. It is designed for use in automatic check-out, cable testing, low level signals and balanced audio (twisted pair) or 4-wire systems. Each module can be set up for various circuit applications by changing boards and spring contact arrangements and can be combined to form a virtually unlimited number of crosspoints. Also shown is the BCD to decimal converter logic for complete computer control.

Each switch station has a 4-pole, 2-throw capability with a neutral off position. Features include low contact resistance, long life and rapid program card interchangeability. The switch is uniquely designed to provide switching of high current with low capacitance and high voltage isolation. A mechanical latching with electrical reset capability insures all circuits will remain in programmed position in case of power failure.

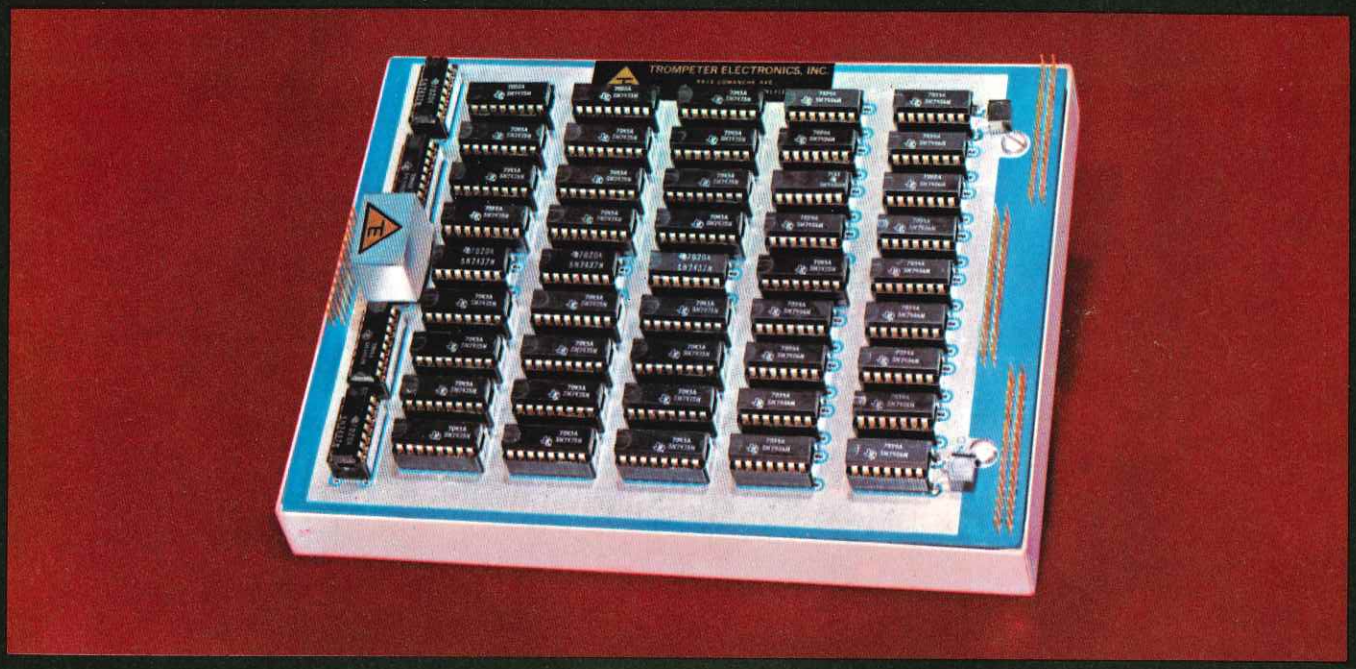


Plug-in board with low capacitance. Contacts for high current. (5 amps NOM.) Each relay is a single pole, single throw. Max. of 12 relays to each board.



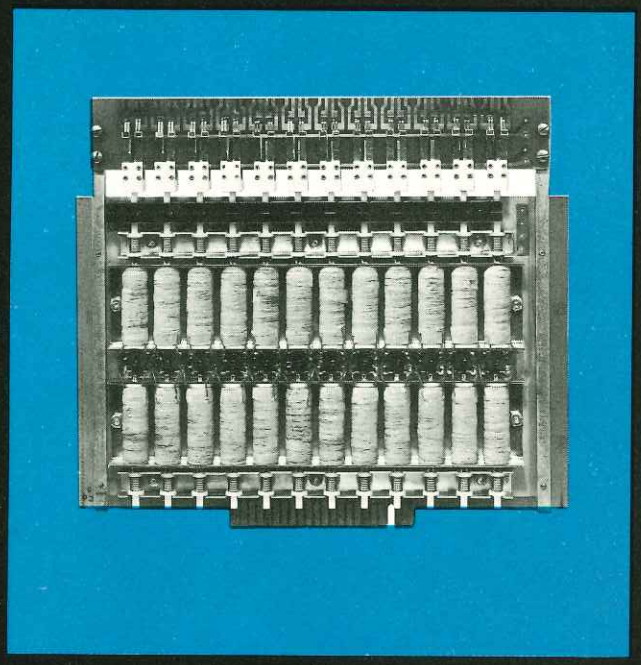
Plug-in board usable for signal switching or relay logic. Pictured are 4 BCD to decimal decoders. Other circuitry available.

LOW FREQUENCY

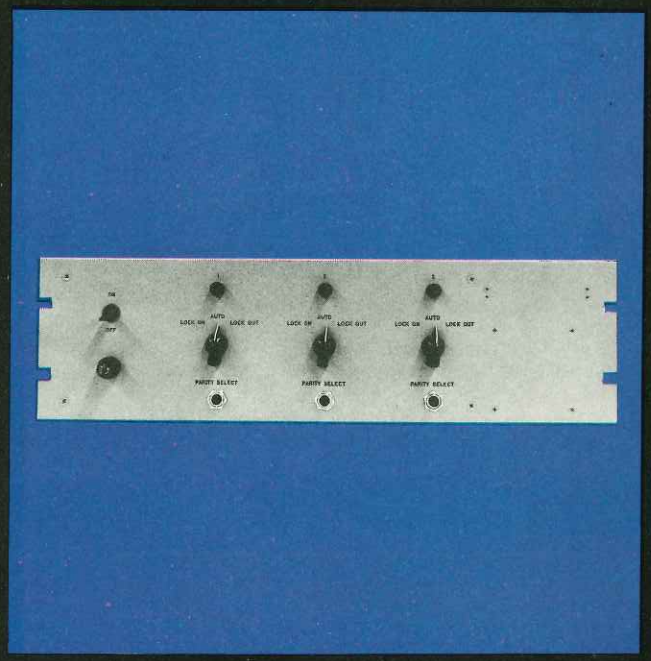


DIGITAL I/O PROCESSOR

The I/O Processor uses 54/74 Series DIPS and accepts 2-parallel 4-bit binary bytes, decodes the binary into a X and Y plane, 0 thru 9 decimal format to drive 100 storage elements. They, in turn, drive 100 relay drivers or output lines. The internal logic functions allow random access for setting or resetting any one of the 100 storage elements, and provide an automatic interlock in the X axis. Further, it is capable of exercising 10 outputs in the Y axis per 2-byte digital command.



Plug-in board — 12 relays — each relay is 4-pole, 2-throw starting from neutral and latching in either throw.



The pictured panel contains logic controlled video switching system with selector switches to provide a choice of automatic operation or manual selection of input to output. Prevention of an input to output connection during operation is designed into the system.

SYSTEMS AND CONTROLS

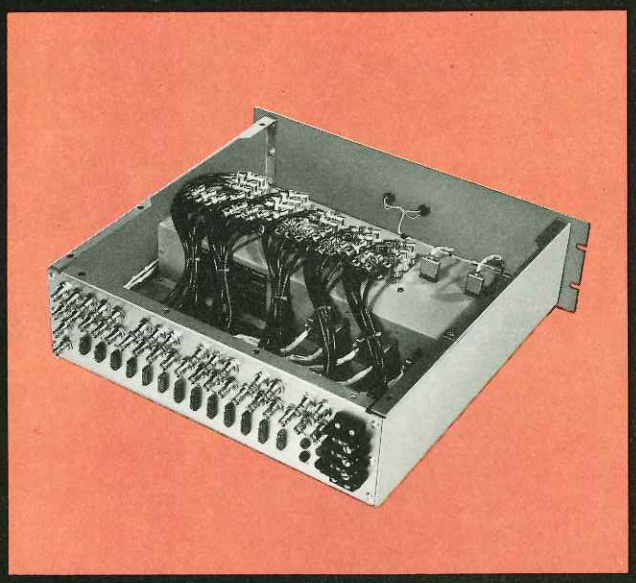
GENERAL SWITCHING SYSTEMS AND CONTROLS

All signal matrices and switches must utilize some type of control, such as push-button, toggle switch, or computer. The selection of the correct type of control is most important and depends to a large degree on the composition of the system.

A small closed circuit TV-Monitor system would employ a simple matrix, a power supply, one or more push-button panels and interface signal and power cables. A large complex antenna switching system, on the other hand, may employ several matrices (mixed or modular) of various sizes, a power supply, a push-button manual control panel, computer control including logic (decoders, relay drivers and etc.) racks, all interface signal and power cables.

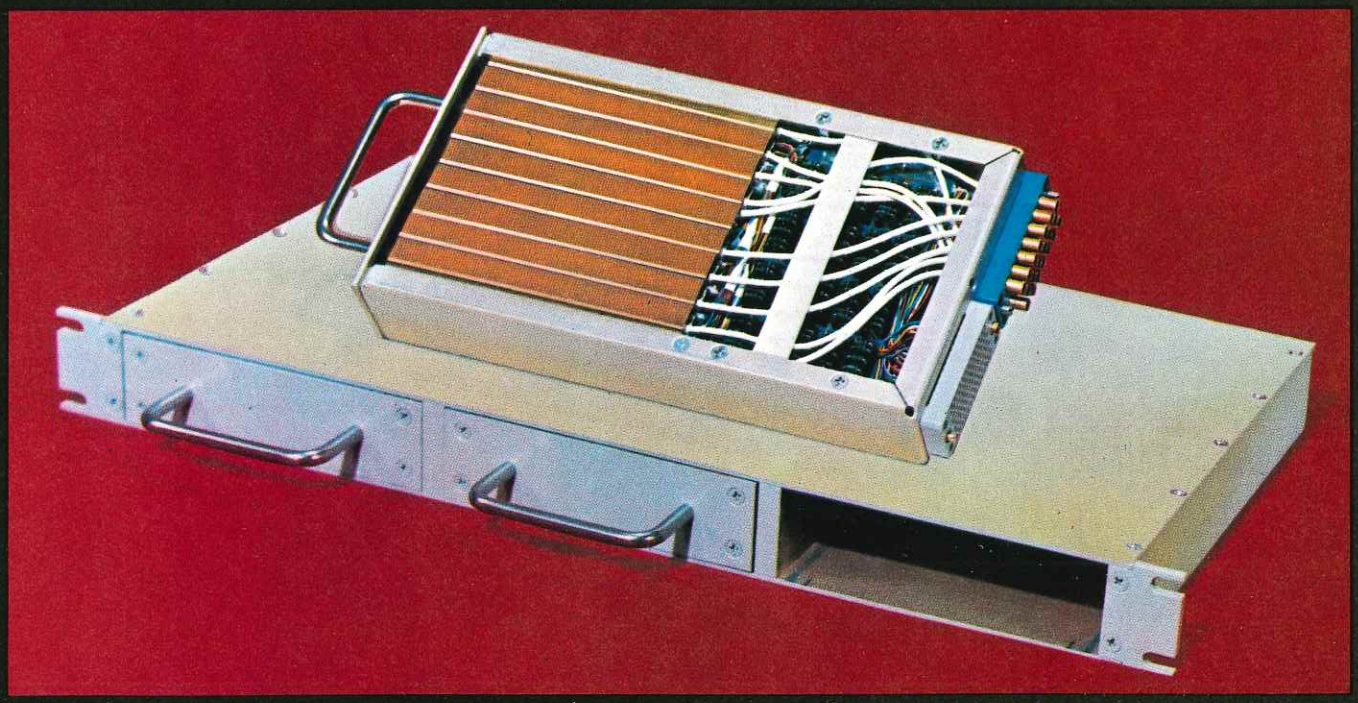
The push-button controls can be supplied in various configurations including lighted and/or engraved buttons, X or Y manual interlock, X and Y electrical interlock and various modes such as push-push or momentary actuation.

Other electro-mechanical controls that can be furnished are thumbwheel shorting or non-shorting, lever switch non-shorting, slide switch, telephone dial or touch control.



MULTISWITCH

The pictured multiswitch contains several coaxial switches and a coaxial matrix. The D.C. control circuitry is completely TTL compatible and diodes are provided for shunting the coil back EMF. 54/74 type DIP relay drivers requiring one TTL load per input, drive the high current requirements of the 5V relay coils and Vcc.



MODULAR COAXIAL MATRIX

Pictured is a 300 crosspoint matrix consisting of three 10x10 modules (100 crosspoints) housed in a 1¾"x19" panel. Control logic can be added to each individual module or can be contained in separate logic modules of the same size. The matrix confiuration provides for almost unlimited expansion.

SYSTEMS AND CONTROLS

TURNKEY SWITCHING SYSTEMS

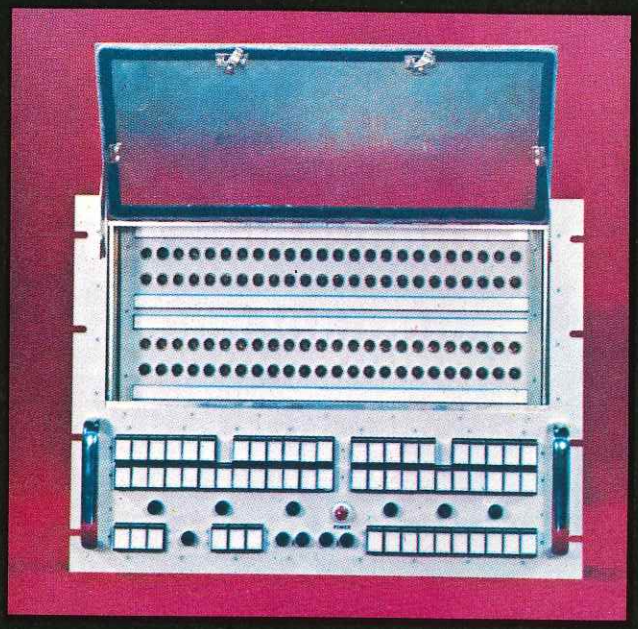
Trompeter Electronics furnishes complete turnkey switching systems including signal matrices/switches, control logic, power supply and interface cables. The systems designed and built by us have run the gamut from simple to complex. All have been custom built and designed by our engineering staff.

A typical "small" system is one that was supplied for process monitoring. It consisted of a single-pole ten-throw coaxial switch with automatic sequencing, adjustable dwell and step time, fast scan control, and self-contained power supply.

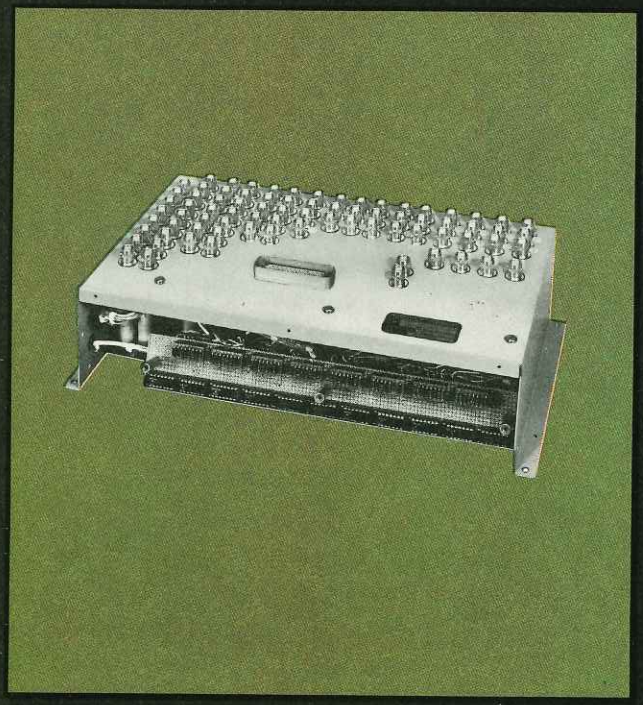
An example of a "medium size" system is one that was supplied to a Far East TV station for interstudio switching. It consisted of a coax video matrix, a Twinax audio matrix, a control matrix, and power supply and control chassis. The control matrix contained the interlock control logic and associated interlock relays. This system provided for X and Y crosspoint interlock while at the same time providing the capability of setting up other crosspoints by means of thumbwheel switches. Change of crosspoint from one mode to another was accomplished through an "operate" push-button. The system was supplied complete with interface cables.

An example of a "large" system is one that was supplied to the Navy. It consisted of three equipment racks containing twenty-nine patch panels, over twenty-eight-hundred coax-matrix crosspoints, networks, complete control logic, six power supplies and all interface cables.

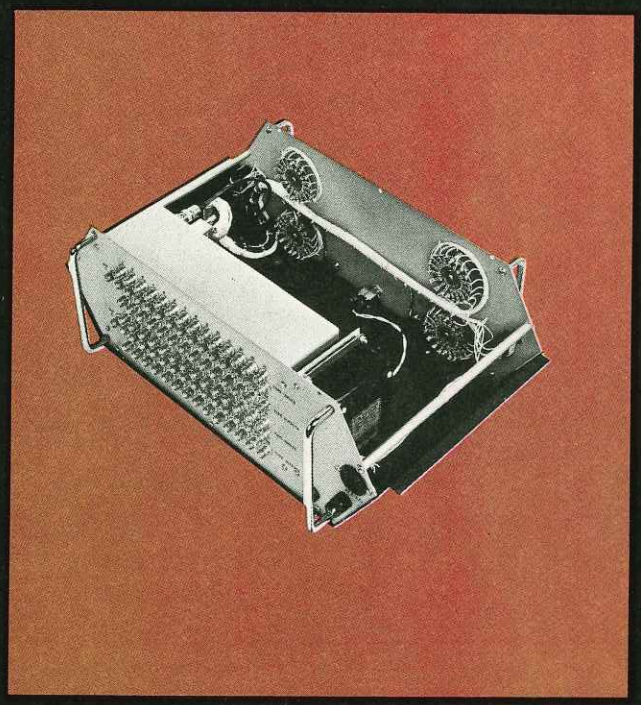
Some other examples of systems are pictured on the following pages.



The unit pictured is a secure switching system and was designed and built to customer specifications. Each unit consisted of two recessed, 48-jack patch panels, coaxial matrices and switches, logic summing, controls and indicators. The patching system, employing self-normalling jacks, provided emergency bypass patching and remote indication of the patch program status.



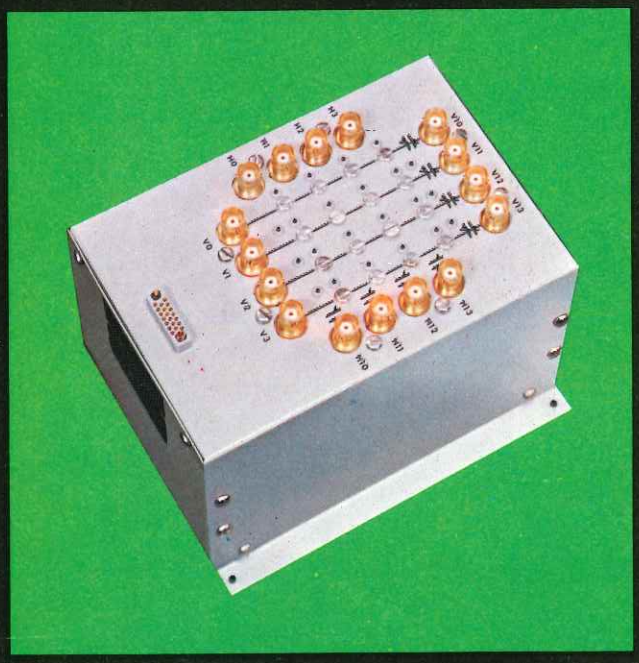
Shown is a hybrid switching array consisting of several types of switches, each of which is electrically isolated from the other, and all are controlled by the use of relay drivers actuated by TTL compatible logic. (cover removed)



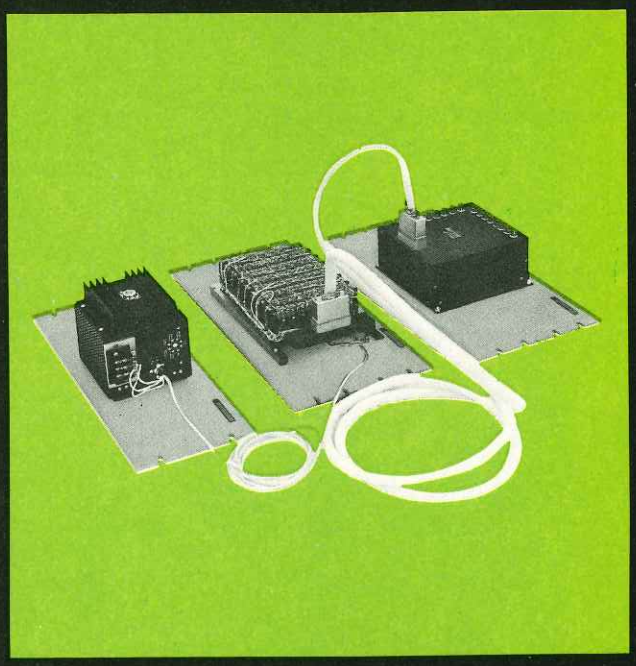
Portable self-contained complete switching system, including power supply and rotary switch control.

(cover removed)

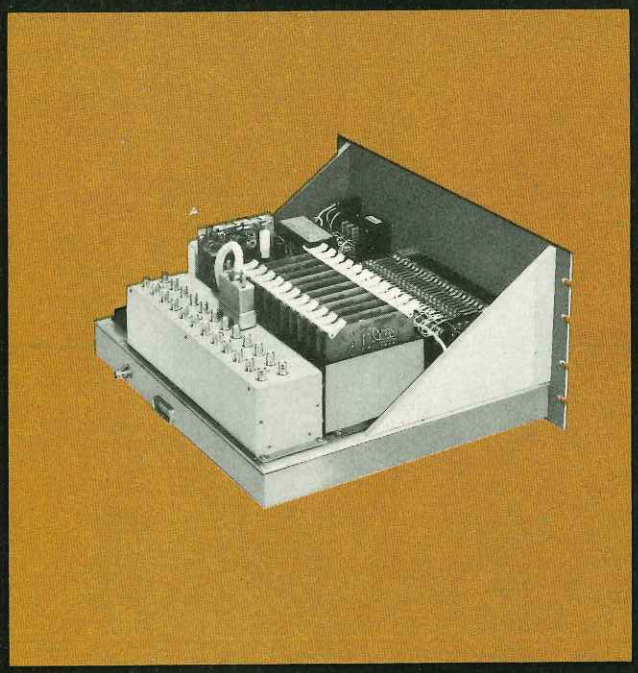
SYSTEMS AND CONTROLS



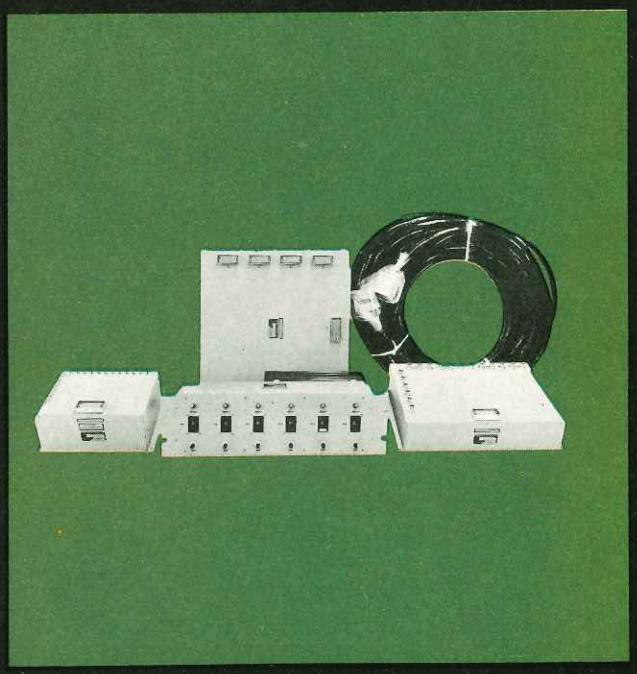
CMVZ 4x4 modular matrix with stub cutoff in both X and Y axis. It was designed to provide combinations of 4x4 or 4x8 matrices.



8 input by 8 output matrix system including power supply, lighted pushbutton control and interconnecting cables.



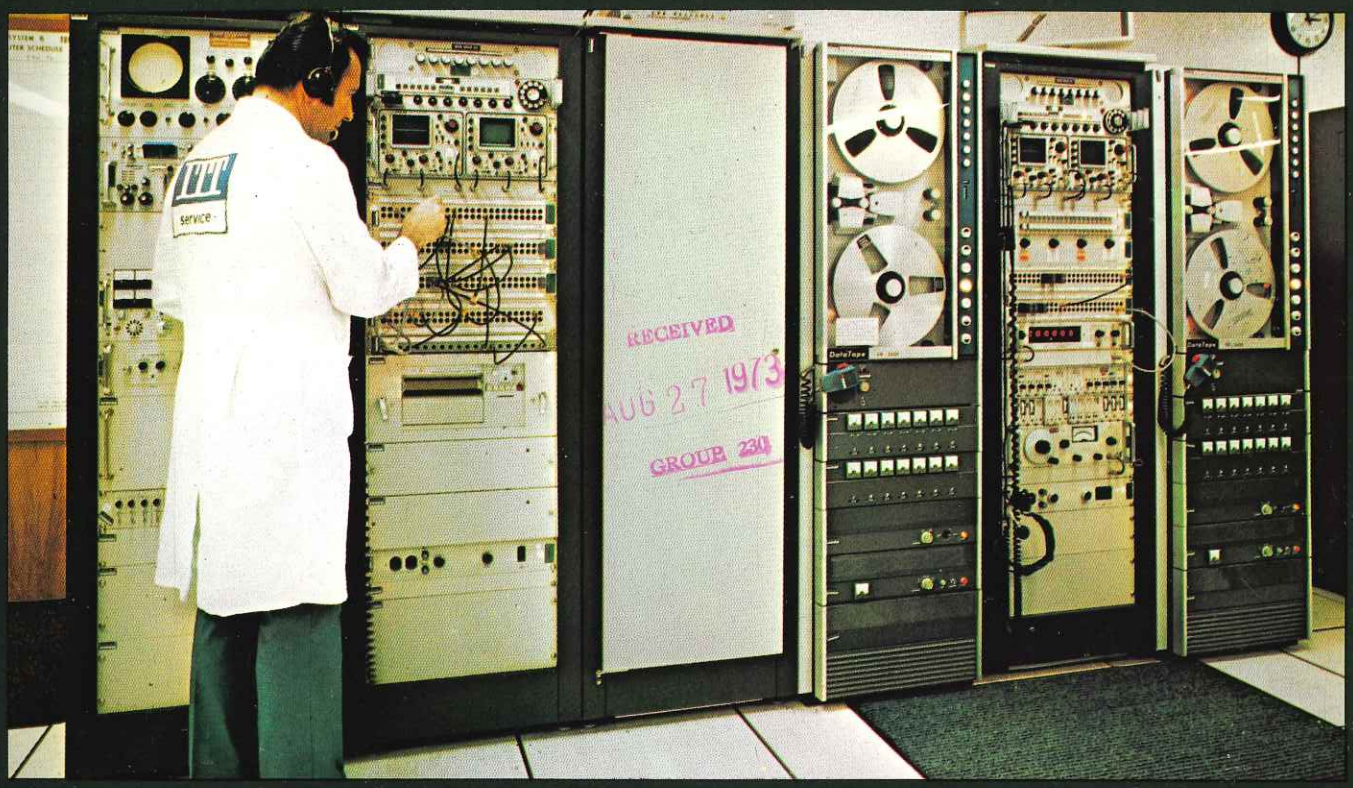
Self-contained coax sequencing switching system. Integral logic controls the sequencing rate and dwell time, as well as restoration of the automatic functions after manual interruption. Manual control and override are accomplished by a series of lighted push-buttons on the face of the panel.



A complex T.V. interstudio control system consisting of vidèo matrix, audio matrix, machine control matrix, pushbutton array, control chassis, power supply and associated cables.

The system provides for a specific camera-studio assignment for any one of a number of camera-studio combinations. Unique controls preventing multi-camera single studio selection and unique status indication are incorporated.

SYSTEMS AND CONTROLS



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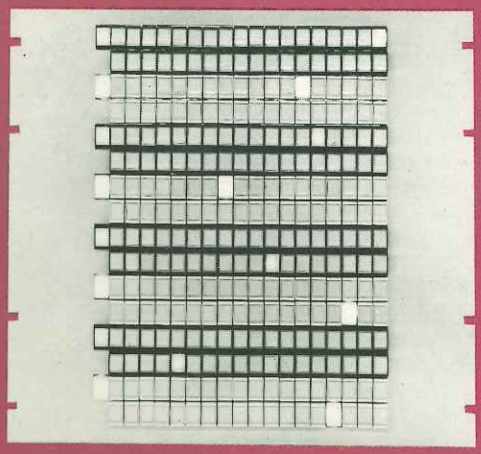
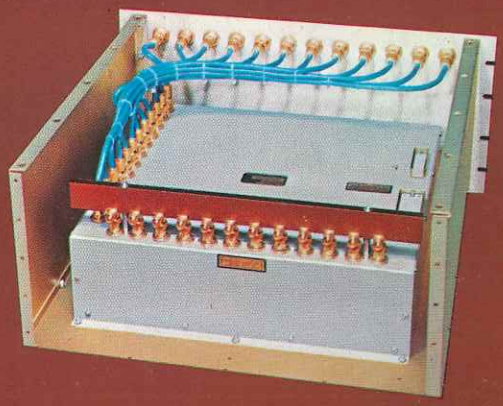
Patching and switching system at a Military Installation.



Lighted pushbutton panel for use with computer controlled automatic checkout. Subsystem contains power supply 2-8 input by 18 output matrices to form a 8x36 matrix, logic and associated hardware.

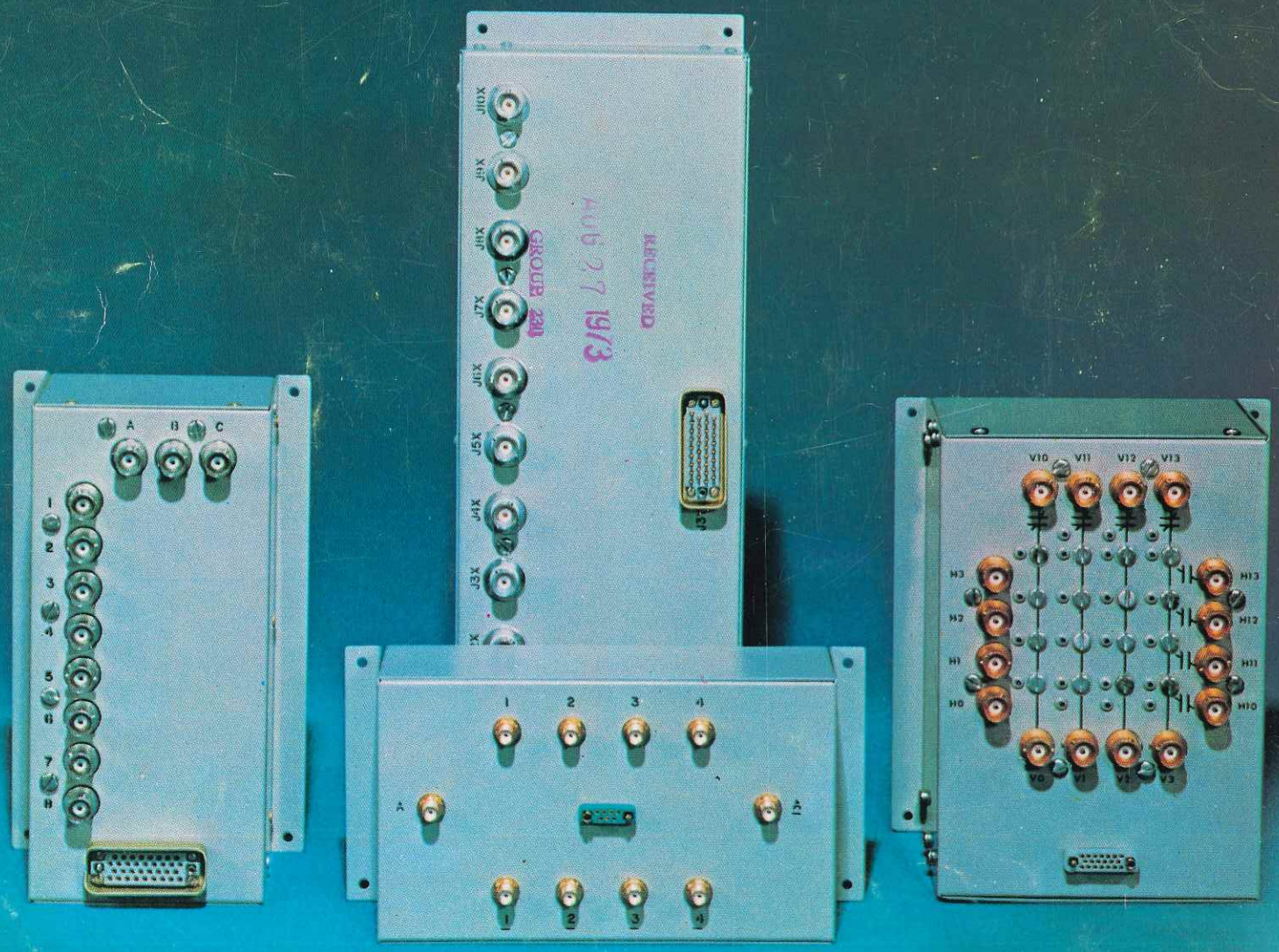


12 input by 12 output Twinax Matrix mounted in a chassis. Features isolation of outer braid from chassis ground, and use of mercury wetted reeds.

TROMPETER ELECTRONICS, INC.

8936 Comanche Avenue / Chatsworth, California 91311 (213) 882-1020 / TWX: 910-494-1210

PATCHING • SWITCHING • SYSTEMS



TROMPETER ELECTRONICS, INC.